Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT

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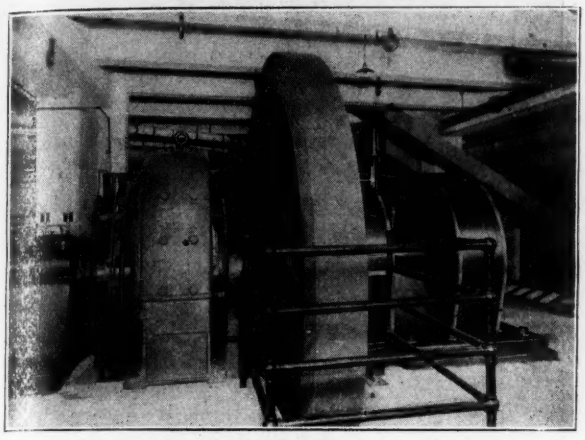
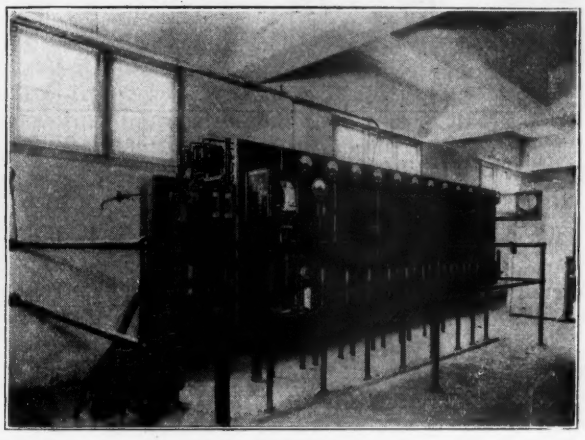


Engine-Driven, 333-kw., 250-volt, Direct-Current G. E. Generator Supplying Power for the 400-hp. Paper-Machine Motor.



Main Distributing Switchboard for Alternating-Current Motors—Panel for 333-kw. Direct-Current Generator at Left.

Electric, Steam and Water-Power Drive in a Paper Mill

Features of Power Generation and Application in Hawley Pulp & Paper Co.'s Mills at Oregon City—Variable-Speed Motors for Paper Machines—Other Machine Drives

One of the important industrial plants at the falls of the Willamette river, Oregon City, Ore., is that of the Hawley Pulp & Paper Co. The spruce and hemlock wood used for paper manufacturing is shipped to the three cut-up plants on the Willamette. The various processes in the pulp and paper mills involve the applications of electric motor drive, steam power and water-power direct.

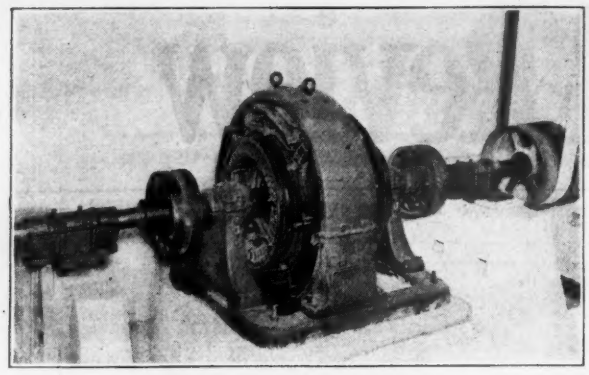
The alternating-current energy used for general motor drives throughout the plant is produced by three hydroelectric units; the direct-current power for operating three of the paper machines is produced by steam-driven generators, the fourth paper machine being operated by steam power direct; the pulp grinders are driven by direct-connected waterwheels.

WATER-POWER UNITS.

The principal hydroelectric unit comprises a General Electric 907-kv-a., three-phase alternator, operating at 2300 volts, 60 cycles, and driven by a 39-in. S. Morgan Smith water turbine, having a speed of 240 r.p.m., and equipped with Woodward governor. This equipment, with all accessories, is installed in the main power plant. The next hydroelectric unit, situated on another part of the river, consists of a General Electric 240-kv-a., 2300-volt generator, belt-connected to a 450-hp. Platt Iron Works waterwheel of the speed of 230 r.p.m. The third hydroelectric unit consists of an Allis-Chalmers 160-kv-a., 440-volt generator, belt-connected to a Platt waterwheel. These units in the generating plants are connected through a bank of three 300-kv-a. Fort Wayne power transformers and two 50-kv-a. lighting transformers. In the main pulp mill there are 10 grinding units of 625 hp. each. Each unit comprises two sets of three-pocket grinders, driven at a speed of 225 r.p.m. by a waterwheel, to which the grinders are direct-connected. In these installations there are seven wheels of the Platt Iron Works type and three of the S. Morgan Smith type. Waterwheels are also employed in operating stock pumps to force the pulp through a 10-in. pipe line from the grinding plant to the buildings containing the paper machines.

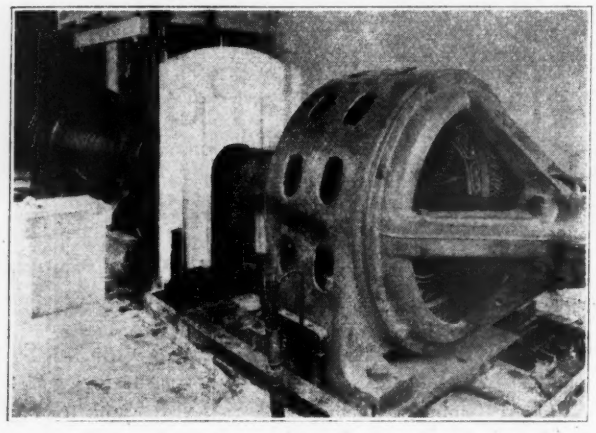
DIRECT-CURRENT MOTOR DRIVE FOR PAPER MACHINES.

One of the features of special interest in this plant is the 166-in. paper machine in No. 4 mill and the equipment for both variable and constant speed that its operation requires. The



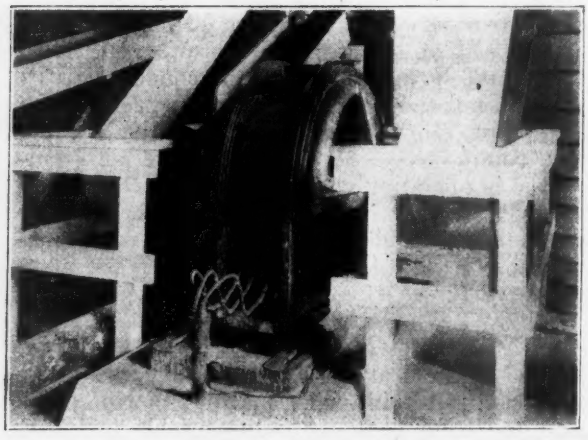
Direct-Current, 400-hp., 245-volt, Variable-Speed G. E. Motor for Driving 166-in. Paper Machine—Speed Range, 75 to 525 r.p.m.

power installation for this consists of a Hamilton Corliss steam engine, direct-connected to a General Electric 333-kw., 250-volt direct-current generator, supplying energy to drive a 400-hp., 250-volt, variable-speed, direct-current motor, the latter being coupled to the 100-ft. lineshaft; through electrical control system a speed variation of 75 to 525 r.p.m. is obtained. Between 525 and 300 r.p.m. the changes in speed are

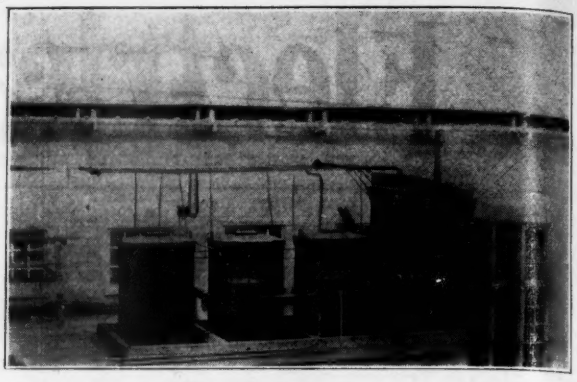


Direct-Connected G. E. Induction Motor for Driving Jordan—150 Hp., 2200 Volts, 400 r.p.m.

effected by field control and between 300 and 75 r.p.m. by voltage control. The pulleys on the lineshaft are slightly conical and are belted to similar pulleys of the lineshaft on the next floor above, by which variable speed is applied to the paper machine, presses, dry rolls, calenders and



G. E. 150-hp., 2200-volt, 450-r.p.m., Induction Motor Driving Two 1500-lb. Beaters.

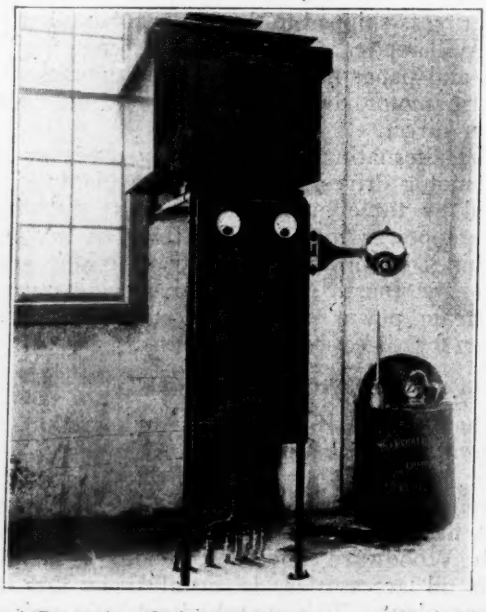


Power and Lighting Transformers for Interconnecting the Power Plants Supplying the Various Mills.

other machinery. The cone pulleys on the variable-speed shafts make possible a more delicate adjustment of the speed of the various paper-machine processes. The same engine that drives the direct-current generator also drives the constant-speed shaft from which various other parts of the paper machine are driven at constant speed.

In mill No. 3 is a somewhat similar variable-speed drive for one of the paper machines, where the installation comprises an engine drive direct-connected to a Westinghouse 200-kw. direct-current generator of 250 volts, 140 r.p.m. This supplies power to a 250-hp. variable-speed motor, giving a speed range of 125 to 375 r.p.m., and made applicable to the processes of the paper machine requiring variable speed. In this arrangement there is provided full automatic control apparatus. The direct-current generator in this case is directly coupled to the constant-speed lineshaft from which are driven those parts of the paper machine not requiring variable speed.

A third paper machine, previously steam operated, is to be motor driven as soon as new equipment for this purpose has been installed. This will consist of an engine-driven General Electric generator, 165 kw., direct-current, 240



Control Panel for 400-hp., Direct-Current Motor Driving Large Paper Machine at Variable Speed—Speed Changes Effected by Field and Voltage Control.

volts, driving a 200-hp., variable-speed motor. The same engine will drive the constant-speed lineshaft of this paper machine.

Other Electrical Features.

The beaters and jordans, pumps and other machines are driven by alternating-current motors, deriving energy from the hydroelectric units at 2200 volts.

In the plant there is a connected load of 1700 kw., of which about 600 is direct current. A 500-kv-a. synchronous condenser, installed in mill No. 4, serves to raise the power-factor. The alternating-current control board contains eight large panels from which all alternating-current motors are controlled. Adjoining it is the panel for the direct-current generator for the large paper machine.

It is of interest to note that on a green plat of ground adjoining the office of the Hawley Pulp & Paper Co. is a stone containing a tablet marking that spot as the site of the first newspaper printed in American territory west of the Rocky Mountains. The name of the paper was the "Oregon Spectator," and the date of its establishment was Feb. 5, 1846.

MEETINGS OF ENGLISH INSTITUTION OF ELECTRICAL ENGINEERS.

Subjects Now Under Discussion—Professor Marchant Opens a New Section at Liverpool.

The English Institution of Electrical Engineers on Jan. 19 opened a new subsection at Liverpool, England, the inaugural address livered by Professor Marchant. He said that the new problems arising in connection with the distribution of electric power from large superpower stations would give electrical men many opportunities for discussing the design and construction of overhead and cable lines. It was only within the last few years that the great importance of an efficient distributing network had been fully recognized and the possibility that there was of economizing capital expenditure by the proper design of the network and by economy in the use of the material employed in cable manufacture.

The problems relating to the application of electric power in chemical processes were only now beginning; its use in that connection would enormously increase when the new superpower stations gave their cheap supply.

In touching upon some of the electrical development work that was at hand Professor Marchant mentioned colliery equipment. He said that at present the colliery was one of the most wasteful places from the electrical engineer's standpoint. The winding engine of a colliery consumed anything from 100 lbs. upwards of steam per useful horepower per hour. This was a field for electrification in these days when fuel saving was so necessary. One of the chief factors that would operate in favor of electrification would be the increasing cost of labor. The ease with which electrically operated machinery could be controlled and regulated would be the deciding influence for or against electrification—more important even than reducing working costs.

During the past year very large numbers of students have entered the universities and technical colleges to prepare for electrical engineering careers. Professor Marchant said that some people might be asking whether they would be absorbed. In his view there is no room for doubt that they will find occupation in electrical engineering when they are fully trained, because of the big developments on the eve of which we now stand. He recognizes, however, that they will be more efficient in carrying out their work as engineers if they are also trained to be better business men by devoting more attention than has been the custom in the past to the economic side.

The program of subjects coming before the Institution of Electrical Engineers either in London or at one of the provincial centers between January and April this year includes the following: Failures of turbo-generators and suggestions for improvements; transformers for electric furnaces; protection of a-c. distribution systems without the use of special conductors; a critical survey of power supply in the Rhine valley; electric clocks; thermionic valves; Rotherham power station (one of the biggest expansions of the kind during the war, for the purpose of the steel and iron industries); some magnetic problems; automatic telephony for private branch exchanges; the future of labor in engineering industry; industrial electric heating; group versus individual driving; electricity supply tariffs.

Eddy Currents in Stator Windings.

H. W. Taylor brought this subject before the Institution of Electrical Engineers at Birmingham, England, in January. He stated that the problem of the elimination of eddy currents from the stator conductors was one of considerable importance in the design of present day a-c. machinery.

A paper contributed by A. B. Field to the American Institute of Electrical Engineers in 1905 had been of inestimable value to designers. It contained, in the first place, a general physical discussion of the problem and concluded with an analytical investigation of some of the usual cases which arise in practice. In the present paper the problem was approached in a synthetic rather than in an analytical manner, with a view more especially to dealing with some of the advanced problems which had demanded consideration during recent years. The subject matter was divided up into the following sections: (1) general physical discussion and calculations of a bottom conductor in a slot; (2) calculation of a conductor higher in the slot than the bottom; (3) depth of conductor for minimum loss and minimum temperature rise; (4) losses in top conductors when subjected to the external influence of currents out of phase with those they themselves carry (as in some conductors of a two-layer fractional-pitch winding); (5) losses in conductors consisting of a number of laminations connected solidly together at the ends; (6) losses in coils in which insulated laminations are continued from turn to turn; (7) losses in conductors and coils in which insulated laminations successively occupy different positions in the conductor.

Power Development of the St. Lawrence River

A Summary of Hydroelectric Power Possibilities in Connection with the Proposed Waterway from Great Lakes to the Atlantic Ocean

By ALEXANDER T. VOGELSANG

First Assistant Secretary of the Interior.

St. Lawrence River from Tibbets Point, at the foot of Lake Ontario, to deep water at the level of Lake St. Francis at St. Regis, N. Y., flows about 113 mi. along the international boundary and has a fall at low water of about 92 ft., of which about 91 ft. is in the lower 48 mi., from Galop Rapids to St. Regis, there being a fall of but one foot in the 65 mi. from Lake Ontario to Galop Rapids. The fall in the lower section of the river is concentrated in a number of rapids which are passed by means of canals and locks on the Canadian side. The Long Sault Rapids, with a fall of 48 ft., extend for about 12 mi. along the lower end of this section.

From St. Regis to ocean navigation at Montreal there is a fall of about 130 ft. in a distance of about 70 mi., of which 129 ft. is concentrated in two stretches of 14 and 8.5 mi., the former including Coteau, Cedar and Cascade Rapids, in which the fall is 84 ft., and the latter including Lachine Rapids, in which the fall is 45 ft.

Tremendous Amount of Power Available.

It is only necessary to consider the immense amount of water flowing in the St. Lawrence River and its uniformity of flow to realize the tremendous amount of water power capable of being developed along the international portion of the river. The mean annual flow at the head of the river, as shown by records obtained from 1860 to 1917, is 241,000 sec.-ft. The effect of the Great Lakes, which act as a great system of storage reservoirs in regulating the flow in the St. Lawrence, is indicated by the fact that the maximum and minimum flow of the river differ by only about 25% from its mean flow. A comparison of this ratio with similar ratios for the Ohio and Mississippi Rivers indicates that the flow of the St. Lawrence is remarkably uniform. The mean flow of the Ohio River at its mouth is about 300,000 sec.-ft., its maximum flow is about three times the mean, and its minimum flow is about one-tenth the mean. The mean flow of the Mississippi at the power plant of the Mississippi Power Co. at Keokuk is about 50,000 sec.-ft. The maximum is about six times the mean and the minimum is about one-fifth the mean.

The amount of theoretical power per foot of fall in the St. Lawrence River, as shown by the mean annual flow, is 27,360 hp., and as a total fall of 92 ft. is available in the international section of the river the theoretical power in that section is about 2,520,000 hp. Assuming that only 70% of this energy can be made available on account of losses in head and inefficiencies of water wheels and generating equipment, this stretch of the river, owned equally by the United States and Canada, would furnish 1,764,000 hp., or 882,000 hp. to each. About 95,000 hp. of the portion belonging to the United States has already been developed by the St. Lawrence River Power Co. by means of a canal which diverts a maximum of 30,000 sec.-ft. from the river near the head of the Long Sault Rapids through the powerhouse into Grass River, which joins the St. Lawrence far below the Long Sault Rapids. Here a head of about 40 ft. is developed. After the power utilized at this development is deducted from the power of the portion belonging to the United States, the power not yet developed in that portion of the river amounts to about 790,000 hp., which is equivalent to about 590,000 kilowatts.

This amount of power is about one-third the total installed generating capacity of all the plants engaged in producing electricity for public use in New York state, slightly more than the installed capacity of generators of similar plants in the state of Michigan, and about 75% of the capacity of those in Massachusetts. In only six states in the United States does the total installed capacity of electric generators in public utility plants exceed 590,000 kw.

Power Consumption Possibilities.

This power may be used near the points of development by industries in which power is a large component of the product or it may be transmitted as a public service supply to power markets that are now dependent on fuels. Doubtless neither of these courses should be followed to the complete exclusion of the other, but it is worth while to examine somewhat the conditions of public power supply within transmission distance of these sites in order to see what the possibilities are of absorbing so large an amount of power.

If the development were so made that a certain amount of regulation of stream flow by storage in Lake Ontario were possible and if load conditions were adapted to the full utilization of all the power produced, it would appear that the share of the United States of the St. Lawrence River power would be about 425,000,000 kw. hrs. per month. The amount of power produced from fuels in public utility plants during the month of February, 1919, in New England and New York state was about 460,000,000 kw.-hrs. The amount of power so produced from fuels during that month in the central New York

region, from Albany to Buffalo, was only about 30,000,000 kw.-hrs., so that if any considerable portion of the St. Lawrence River power were to be marketed for use by public utilities it would have to be transmitted to the metropolitan district of New York, a distance of about 350 mi. Here there is now produced from fuel at least 300,000,000 kw.-hrs. per month. Much of New England is within a transmission distance of 250 mi. and requires about 150,000,000 kw.-hrs. of fuel-produced energy monthly for public service alone.

The industrial plants not supplied by public service companies use a large additional but unknown quantity of energy. The transmission of these quantities of power over the distances indicated is unprecedented but is not to be regarded as unattainable in the present state of high-tension operation. In view of these requirements, there should be no reasonable doubt that there would be an ample market for all the power that can be developed on the St. Lawrence. The annual value of our horsepower would be about $12,000,000, and figured on a 5% basis would show a capital value of $240,000,000.

The utilization of this power in public service to replace coal now consumed in the large manufacturing centers of New York and New England has an important bearing on the extension of the life of our coal deposits. On the basis of three pounds of coal per kw.-hr., this St. Lawrence River power is the equivalent of about 7,750,000 tons of coal annually, which is about 1.3% of the total production of bituminous coal in the United States in 1918. The amount of coal consumed per year by public utility plants in New England and New York is only about 7,000,000 tons.

Power Development Would Give Opportunity for Enlarged Industries.

If, on the other hand, the demand for electrochemical and other products requiring large quantities of power increases, these water powers will give opportunity for greatly enlarged industrial development. Doubtless most of the power developed on the Canadian side, not only in the boundary portion of the river, but in the purely Canadian portion below, would be utilized for such purposes. This portion is within easy reach of the largest commercial centers, and after the St. Lawrence has been made more fully available for navigation it would be possible for ocean shipping to reach the factory sites. Assuming, as seems entirely probable, that these developments are made at low cost and can deliver power at attractive rates, it is entirely likely that this power can be marketed as rapidly as it can be developed.

Under normal conditions, the railroads, especially those in the northeastern part of the United States, are overburdened with coal. From 35 to 40% of their cargo space is given up to the transportation of coal. The full utilization of the water powers of the St. Lawrence would reduce greatly the tonnage of coal to be moved into New York and the New England States.

The saving in man power by producing energy by water power, as compared with steam power, is large, especially if the number of miners required to provide coal is considered. A large southern power company shows, by comparing the number of men needed to operate one of its hydroelectric plants on the Coosa River with the number, including the miners, needed to operate one of its steam plants, that in a water power plant one man is required per 5250 kw. of capacity, whereas in a steam plant one man is required per 74 kw. of capacity.

Applying these figures to the water power available on the St. Lawrence and assuming that the 590,000 kw. of water power would replace the same amount of steam power, about 7900 men would be released for work in other fields.

The power possibilities of the St. Lawrence have therefore very large economic importance, and any plans for developing the river for navigation should make provision for the maximum development of the energy that it will afford.

The availability of the water power of the St. Lawrence should also receive the most careful consideration if Congress authorizes Secretary

Relation of Power Supply to Industry

More than a million men are now engaged in producing mineral fuels, the consumption of which expends and exhausts the stores of nature. On the other hand, the white coal of falling water is exhaustless, is everlasting. Any project that will lower transportation costs and at the same time yield energy for the use of man conforms to modern economic thought.

There is a growing tendency to redistribute those industries of the country which require large amounts of power to locations where water power is abundant and cheap. Thus, water power will control the location of those industries in which the cost of power is a large item in the value of the product.

Dr. Steinmetz estimates the theoretical maximum of hydroelectric power of the United States at 320,000,000 hp., though of course but a fraction thereof can be made practically available. The Geological Survey estimates the amount practically available to be 54,000,000 continuous hp., and of this the boundary waters in question can produce 2,000,000 hp., half of which is ours.

The census of 1912 shows the developed water power of the United States was 4,870,000 hp. According to that census, the installed capacity of stationary prime movers was 30,000,000 hp., furnished by water, gas and steam. This does not include power generated in locomotives, marine engines, automobiles and such apparatus. The average power furnished by these prime movers was probably not more than 20% of installed capacity, so that power produced in 1912 was probably not more than 6,000,000 continuous hp.

Of the developed water power in the United States 70% is west of the Mississippi, and of the stationary prime mover horsepower over 70% is east of that river. Thus it is seen that the East is rapidly consuming the expendable resources of power, and that if she continues to sleep upon her water-power possibilities she may soon see the transfer of many of her great industries to the enterprising, forceful and ever-alert West.

Lane's plan for a power survey of the North Atlantic industrial region.

POSSIBILITY OF CONSTRUCTING SUPER-TRANSMISSION LINE IN THE EAST.

It is now three years since Congress was urged to authorize a study of the power possibilities of the congested industrial part of the Atlantic seaboard with a view to disclosing not only the fact that a great saving in power could be effected and a much larger actual use of the power now produced could be gained but that new supplies could be obtained both from running water and from the conversion of coal into power at the mines instead of after a long haul. The feasibility of constructing a super-transmission line of electric power paralleling the Atlantic from Richmond to Boston, affording connections at New York and Boston with the vast water power resources of the St. Lawrence on the north and Niagara on the west, a main transmission line into which would run many minor feeding streams of power and from which would diverge an infinite number of small delivering lines tying together the separated power plants of ten states, so that one could give aid to the other, so that one could take the place of the other, so that all may join their power for good in any great drive that may be projected, may well be investigated by the government, not with the thought that the government would construct or even operate such a trunk line, but that the project might attract the attention of the engineering and financial world to make it a reality.

Such a system of transmission lines would take from the coal mine and the railroads much of their burden and insure the operation of street lights, street cars and essential industries in the face of railroad delinquencies.

The demand for power for the use of industrial and public utilities in New England and New York is increasing. Winter conditions like those of 1917-1918 would again cause, and to a greater degree, the same difficulty that then occurred in supplying coal to the country's essential industries. The water power of the St. Lawrence would furnish sufficient energy to supply a large part of the power now generated by fuel in the northeastern part of this dominant industrial district of the United States. The demand for power in this district would undoubtedly consume all that portion of the St. Lawrence power that belongs to the United States and all of that portion of Canada's share for which there was no demand in that country.

$6,000,000 EXPANSION IS PLANNED BY ARMOUR INSTITUTE.

J. Ogden Armour Will Furnish Money for New Site and Buildings in Chicago.

New buildings to cost $5,000,000 will be erected in the near future by the Armour Institute of Technology, Chicago, on a site at 75th street and Yates avenue, Chicago, the land costing $1,000,000 having been given to the Institute by J. Ogden Armour, Chicago, who will also furnish $5,000,000 for the new buildings.

The new site is an unbroken tract of 80 acres, lying in the heart of the industrial section of South Chicago, and was about to be cut up into building lots when Dr. Frank W. Gunsaulus, president of the Institute, interested Mr. Armour in the expansion proposition with the result that the 80-acre plot was bought intact.

Several years ago the Institute outgrew its present quarters at 31st and Federal streets and at that time Dr. Gunsaulus conceived the idea of building a great institution away from the crowded districts of Chicago. The new Institute will have a capacity of 1000 students, and located as it will be near the giant steel mills of South Chicago, it will be in a position to enlarge on its plans for the teaching of industrial training. Situated also within a few blocks of Lake Michigan it will have great opportunities for teaching and experimentation in marine engineering.

The Armour Institute of Technology was founded by the late P. D. Armour in 1892. Its purposes were outlined as follows at the time of its foundation:

"This institution is founded for the purpose of giving to young men an opportunity to obtain a liberal education. It is hoped that its benefits may reach all classes. It is not intended for the poor or the rich as sections of society, but for any and all who are earnestly seeking technical education."

Under the enlarged plans, details of which will be announced later, the institute will take rank among the greatest in the country.

NEW YORK ELECTRICAL SHOW WILL FEATURE INDUSTRIAL DISPLAYS.

With practically all the space on the main floor spoken for and reservations being made on the second and third floors, the New York Electrical Exposition promises to be more interesting this year than ever before. The exposition will be held at the Grand Central palace and George F. Parker, the general manager, has announced the dates as Oct. 6 to 16.

A feature which will be of great importance in these days of high speed production will be the industry display, occupying the greater part of the second and third floors. Here will be shown the different types of electrically operated machines which do the work that formerly required a large force of men. Electric spot-welders will be shown doing the work that has done away with the old time rivet process. Electric lathes and drills will be arranged to show the advantages of the motor-driven factory over the shop that is encumbered with belts and shafting. Electric industrial trucks such as are used not only in factories but also at practically all the important freight stations will be shown in operation. A space 70 by 170 ft. on the third floor has been set aside for the demonstration of these industrial trucks. Several floor obstructions will occupy this space, affording an excellent opportunity for demonstrating the ease of handling and the flexibility of the little freight carriers. Almost as great an advantage as its carrying capacity is the ease with which these trucks can negotiate crowded passageways and sharp turns.

In addition to these industrial exhibits there will be interesting displays of electric appliances for the home and for the office.

Grounding and Polarization as Protecting Measures—Part I

What, Why and How Certain Electrical Circuits Should Be Grounded in Order to Afford Sufficient Protection Against Fire and Life Hazard

By W. J. CANADA

It is a fact that a subject, through much debating, frequently becomes at last surrounded by a haze of misunderstandings which persist to embarrass us. We earnestly desire a clear understanding but find no time to sufficiently analyze the subject and separate the false impressions from the true. Under such circumstances a very simple and brief analysis of the entire matter, even though it has the disadvantage of repeating many facts already circulating about our mental systems, may have the greater advantage of bringing us to the necessary clear understanding, by presenting a true picture of the whole subject in one frame, and without any false lights.

Grounding as a method of protection against abnormally high voltage on circuits and apparatus is one of those subjects which has been debated for many years. Indeed, a resume of its history and development would be instructive as well as interesting. But such a story might still leave us without a clear picture of the merits of this protective measure. It seems for our purposes more essential to describe the grounding requirements as they stand today, to briefly explain the reasons for such rules and the manner in which they accomplish their object. Although, even today, some persons are still uncertain as to the desirability of grounding and a few continue to repeat some of the objections which in the past have been raised and answered against grounding from time to time, we shall find it undesirable to attempt to review and emphasize these objections and the answers to them, except as some of them are brought up in the discussion. Thus we may hope to keep our picture as clear as possible.

What Should be Grounded?

We shall assume that it has been proposed, as a new matter, that certain circuits and apparatus be grounded as a protective measure and that we, as entirely open-minded persons, merely ask what should be grounded, why and how? The answers to these three simple questions are exactly what we all wish to learn about grounding. If the answers are clear and complete they will not only convince us, but secure our understanding and co-operation in making proper grounding rules effective. If the adequacy or clearness of the answers to these questions seems in doubt, they should be cross-examined to assure that they do not fail in any respect. If the case for grounding then appears unassailable, we shall all become its whole-hearted supporters, as in fact many of us already are.

First then, what should be grounded? "Letting the National Electrical Code decide" for us, we can say broadly: The comparatively low-voltage circuits supplying wiring and fittings in premises used by the general public and near enough to persons or processes or to grounded surfaces so that a leakage to persons, implements, structures or contents might otherwise occur; also the metal frames of fittings used for such purposes.

We must qualify this broad classification of circuits and equipment which should be grounded by exempting certain circuits and equipment from grounding requirements where the hazard if ungrounded can be shown to be comparatively small and the trouble or expense incurred in grounding are demonstrably or supposedly so great as to entirely offset the advantages of grounding.

In general, any circuit supplying utilization wiring should be grounded if exposed to much higher voltages to ground than exist normally in the circuit itself. Such exposures may be through transformer windings or through the unavoidable proximity of the low-voltage circuits to higher voltage wires in overhead construction. A-c. circuits to utilization wiring are almost invariably exposed through transformer windings and frequently through overhead wiring; and d-c. circuits, if in overhead wiring, are usually exposed in a similar way. There is a further advantage in grounding circuits where these are three-wire, as explained later. The Code at present exempts from grounding requirements circuits not exposed by others exceeding 550 volts to ground, a-c. circuits which cannot be so grounded as to prevent the circuit from exceeding 150 volts to ground (a circuit over 300 volts between wires for instance), and two-wire d-c. circuits in all circumstances. It does not exempt three-wire d-c. circuits of any voltage if exposed by circuits of higher voltage than 550. It should be noted, too, that the Code does not prohibit the grounding of any circuit. If there is any reason for not grounding any kind of circuit it is not connected with the safety of premises or persons.

Grounding of Equipment Frames.

In general, all frames of equipment supplied from utilization circuits should be grounded, since exposed to the voltage of the circuit to which connected. The Code exempts from grounding requirements the frames of a great many types of equipment, though its tendency has been toward reducing these exemptions. Few of these devices are specifically exempted, the exemption rather being by default of any specific requirement for grounding, as though the presence or absence of this protective con-

nection were immaterial or the subject had been overlooked. Among such devices exempted from grounding requirement through absence of any mention of this protection are outline trough work, moving-picture machines, theater portable equipments, bunches, strips, borders, footlight boxing, air-cooled transformers, lamps of all kinds, and sockets. A few exemptions are specific, as with electric lighting fixtures. On the other hand, metallic runways of all kinds, heating devices, metal boxes, motor frames and the like are, in general, required to be grounded, unless too great a difficulty is involved. In some cases the rules are quite loosely worded; for instance, "cabinets not on a conduit system, are not required to be grounded," but the intent and trend of the Code rules are clear enough.

It may be remarked in passing that those types of electrical equipments, the frames of which the Code at present specifically requires grounding, are those types where in the past the constant recurrence of accidental grounding and fires brought about a consistent demand for such a ruling; whereas electrical equipments for which grounding has not yet been required have as yet in general supplied no correspondingly complete evidence of the advantages of grounding in the experience of any one individual or organized group. No one is urging their grounding.

In addition to protective grounding of circuits and equipment, the wires of circuits are now required by the Code to be identified, as are also the terminals of fittings. As this requirement, only recently included in the Code, was considered to call for increased production and stocking of wire and fittings, it was held in abeyance during the war and has not yet been made effective. This identification is a corollary of the grounding proposition and extends its advantages. In conjunction with the grounding of circuits and equipment frames, identification of wires and fittings, as will be later explained, accomplishes a definite polarization of the entire circuit, by which voltage stresses on certain connected devices are minimized and safety to users and premises are correspondingly enhanced. The rules governing polarization are now only in formation and after being revived by the Electrical Committee, which biennially revises the Code rules, must be considerably expanded into specific requirements to bring them to a state of real helpfulness.

Before passing on to the answer to the next question, "why should we ground in the various cases above referred to," I would request that any who have noticed omissions or errors or ambiguities in this brief statement of "what should be grounded," will make written note of these and bring them forward for the later discussion, thus making this résumé of the grounding subject as useful as possible.

Why Should Protective Grounds Be Made?

The simplest answer to this question is that grounding prevents an unsuitably high voltage on the object grounded, so as to protect the premises in which the object is located and the persons who may come in the vicinity of the object. Of course, such an answer presupposes that there is a possibility of unsuitably high voltages and that grounding will prevent this. As unsuitably high we might class all voltages considerably higher than those designed to be present on the object in question, the degree of unsuitability and danger, both to persons and premises, being according to the excess over the normal voltage and the location of the object in reference to premises and persons. If there were no possibility of a dangerous voltage, or if grounding would not prevent, grounding should not be required.

Discussing first the possibilities of unsuitably high voltage on circuits, we may first state that any unprotected electrical circuit exposed by a higher voltage circuit may by contact with that circuit or leakage from it have its own voltage raised to anything from its own normal voltage up to that of the exposing circuit. It may be well for clearness in the minds of all to state that by voltage we mean, of course, voltage to ground, since this is what measures the hazard of an interior wiring circuit and connected fittings to the premises and other objects. It may be noted, too, that the voltage between wires of a circuit is not determined by contact with wires of some other circuit, but is fixed by the generator or transformer winding from which the circuit is energized. A few charts will illustrate better than formulas how any ungrounded circuit may have its voltage (to ground) raised by contact or leakage from a higher voltage circuit, also how proper grounding will prevent this danger. For simplicity, two-wire a-c. circuits are shown. If the lower voltage circuit is d-c., the voltage-raising effect is the same. The only difference is that the accidental contact of a higher voltage circuit with a d-c. circuit could of course, take place in only one way and that through adjacent overhead wiring.

Discussion of Fig. 1.

With a primary and secondary both entirely insulated from ground and with no cross between the voltage relations are as shown, both circuits straddling the earth, as a result of capacity effect, and both at their minimum voltages to ground.

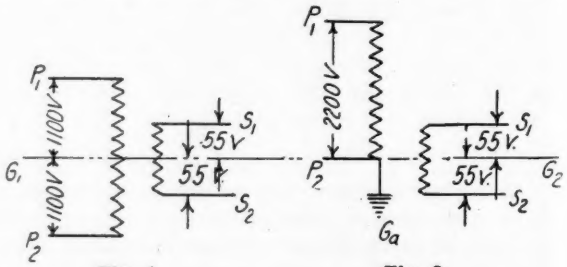


Fig. 1.

Fig. 2.

An accidental ground on the secondary under these circumstances is a not unusual occurrence and it produces no dangerous voltages on the secondary.

Such a condition as shown is an unstable one, entirely unreliable, and one or all of several contingencies may be anticipated sooner or later and should be guarded against.

Discussion of Fig. 2.

Fig. 2 illustrates one of these contingencies—an accidental ground of uncertain but probably

high resistance on one of the primary-circuit wires.

There is no effect on the secondary voltage, but there is an increased stress on the insulation between primary and secondary, the primary voltage to ground being doubled.

This is a frequent condition of the ungrounded primary, but this, too, is an unreliable state, and another contingency is likely to occur at any time.

An accidental ground on the secondary is harmless so far as high voltage is concerned and is not unusual.

Discussion of Fig. 3.

This illustrates an occurrence far from rare with ungrounded secondaries, where the primary, for the time being, is reasonably free from grounds, but an accidental cross has occurred to the secondary. The secondary of smaller extent does reduce the primary voltage on the crossed side, but leaves it at something like its original voltage. The secondary will continue at

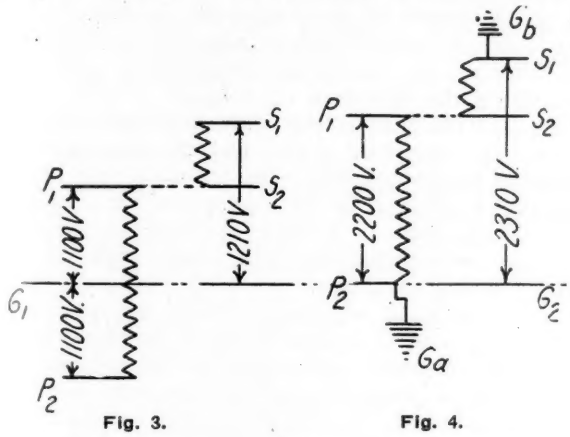


Fig. 3.

Fig. 4.

this dangerous voltage until some breakdown of its insulation to ground occurs. Then it will come to its approximately normal voltage, unless a ground accidentally appears on the other primary wire, raised through the previous occurrences to the full 2200 volts above ground. This illustrates how the voltage of an ungrounded secondary is likely to vary through a wide range of dangerous voltages.

Discussion of Fig. 4.

If a primary is accidentally grounded on one wire and its other wire is accidentally crossed with a secondary, whatever the chronological order of those occurrences, the secondary is raised to a dangerous voltage unless or until it relieves the danger by a breakdown of its insulation to ground.

If such a breakdown occurs, unless its resistance is unusually low for such an accidental ground, the high voltage will be reduced but not done away with. If both grounds are of rather high resistance, no primary fuse will be blown to relieve the danger. If the sum of the two resistances is small, enough current may flow through the short-circuit thus formed to put the primary circuit out of action. If each ground is 25 ohms, the secondary voltage will remain at about 1100 volts unless the primary fuse in circuit is less than 40 amperes capacity. To safeguard against crosses with primary circuits of large current capacity, low-resistance secondary grounds are evidently necessary, and these are rarely met with in accidental grounds.

Discussion of Fig. 5.

Where the primary is designedly grounded, but is not accidentally crossed with the secondary, the latter remains at its normal low voltage to ground.

However, such an accidental cross is likely to occur, and, as shown in Fig. 6, the secondary

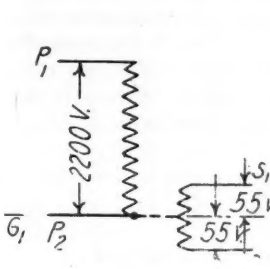


Fig. 5.

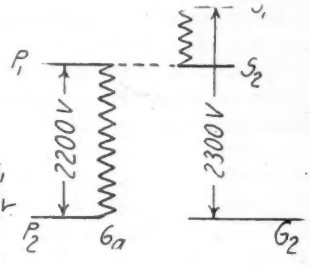


Fig. 6.

is likely to go as near to full primary voltage as the breakdown of its insulation will permit. Of course, insulation breakdowns are accompanied by personal and property dangers.

Discussion of Fig. 7.

If with the accidental ground on primary and accidental cross to secondary, the secondary is designedly well grounded, all high-voltage danger on the secondary disappears. With a G_b resistance as little as one-tenth that of G_a, the secondary voltage would not be raised over 200 volts, even if the primary were entirely unfused.

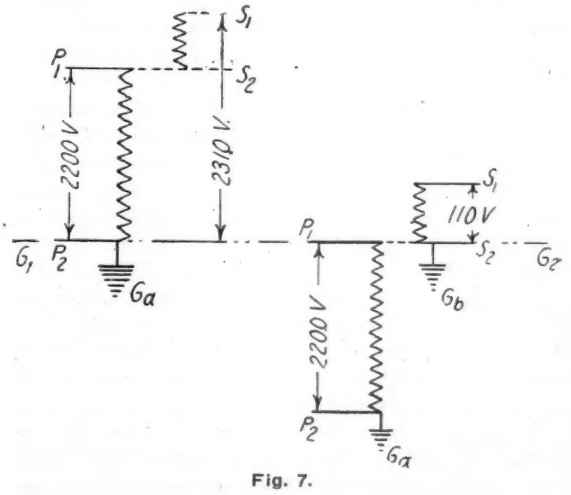


Fig. 7.

Even a poor secondary ground, such as an artificial ground, will protect if relatively much better than the accidental primary ground.

If now we consider the case where primary has a good low-resistance ground, the secondary ground must also be a good one, but not necessarily of much lower resistance.

For instance in Fig. 8, if the secondary ground is 2 ohms and the primary only 3 ohms, the primary fuses will blow, even if as large as 400 amperes. However, the secondary voltage is instantaneously raised by the passage of this large current and a 1-ohm resistance would reduce

this voltage rise by 50%. A 1-ohm resistance is readily obtained with water-pipe connections.

Experience confirms our anticipation from such considerations as just discussed that there is a chance for leakage from a high-voltage and low-voltage circuit and that grounding will prevent. Such a leakage may be caused, as general experience shows, by breakdown of insulation in a transformer, by contact of two overhead wires, by leakage through a piece of wire thrown or fallen upon the two sets of wires, or by a twig fallen upon the wires or rubbing against them in a breeze. Experience also shows that such high-voltage leakages are much more frequent on a-c. circuits than on d-c. circuits. This is because the d-c. circuits are more commonly found in congested communities and therefore underground, and because there is no transformer concerned.

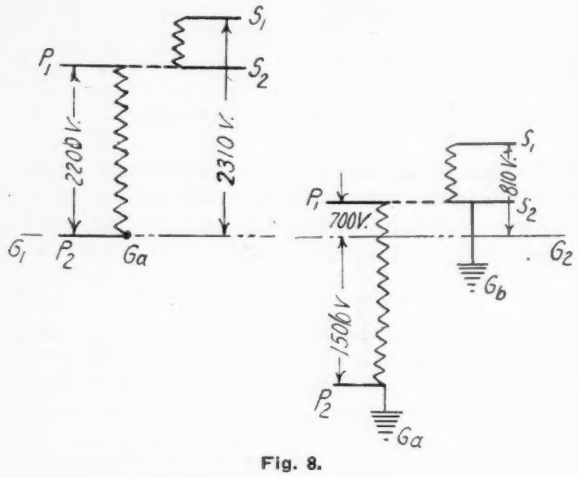


Fig. 8.

It is partly for this reason that the grounding of low-voltage secondaries has been much more discussed than the grounding of low-voltage d-c. circuits.

Another possibility of unsuitably high voltage to ground exists on many circuits, entirely apart from their exposure by higher voltage circuits. Any ungrounded two-wire circuit may have either wire at full-circuit voltage to ground by reason of an excess leakage from the other wire to ground. If the leakage is equal from both wires, or if no leakage exists, the voltage to ground of the two wires will be a minimum, equal to half the voltage between them. With three-wire circuits the minimum voltage to ground will be obtained when the middle wire is at ground potential. If either outer wire is accidently grounded the other outer wire takes on double its normal voltage to ground, an unsuitably high voltage. The same possibility of increased voltage to ground in outer wires exists in ungrounded multiwire circuits of all kinds.

As to whether a certain voltage on a circuit is unsuitable depends on the relation between it and the voltage normal to the circuit. A voltage several times as high would certainly be unsuitably high and afford the best of reasons for protective measures. A voltage only double the normal causes a much less degree of unsuitability. A voltage increased only a few per cent above the normal voltage can hardly be considered actually suitable from the safety viewpoint.

(To be concluded.)

EXPLAINS VALUE OF ELECTRICAL PROPULSION OF SHIPS.

Eskil Berg, of General Electric Co., Talks to Lynn (Mass.) Section, A. I. E. E.

Before the Lynn Section of American Institute of Electrical Engineers on February 18, Eskil Berg, of the turbine department, General Electric Co., Schenectady, gave an instructive illustrated lecture on "The Electric Propulsion of Ships." In his address he showed that the best steam engines of the triple and quadruple expansion type cannot, on account of the size of the low-pressure cylinder, be made with an expansion ratio of more than 20 to 1. In the turbine, however, an expansion ratio of 400 to 1 can readily be obtained, the lower limits being entirely governed by the temperature of the cooling water going to the condenser. The turbine can realize about 25% more of the energy in the steam than the reciprocating engine and can do this about 50% more efficiently.

Electric transmission affords a simple and practical means of speed reduction in almost any ratio desired and affords a means of reversal by a change of electrical connections without changing the direction of rotation of the turbine. In the case of war-ships a feature that is especially important is that electric transmission affords means by which the ratio of speed reduction is changeable by simple electric connections, thus making possible the economical use of the same apparatus both under high speed and cruising conditions.

In his address Mr. Berg treated the question of the electric propulsion both of warships and commercial vessels, and expressed his conviction that electric propulsion affords the only certain means by which the highest known standard of economy can with perfect safety and certainty be applied to vessels of many types. In the case of almost any large ship now operating with reciprocating engines on long voyages an electric propulsion equipment could be substituted which would afford enough improvement to pay for itself in reduced operating expenses in three years. In Mr. Berg's opinion, such possibilities cannot be long disregarded.

After the lecture the film, "Queen of the Waves," illustrating the first electrically propelled dreadnaught, U. S. S. *New Mexico,* was shown. There were about 200 at the lecture.

DEFECTS OF RAILROAD MOTIVE POWER POINTED OUT.

A. H. Armstrong, assistant engineer, railway and traction department of the General Electric Co., addressed the Schenectady section of the American Institute of Electrical Engineers, Feb. 20, on "The Last Stand of the Reciprocating Steam Engine." Mr. Armstrong outlined the present conditions of American railroad systems and pointed out the inherent defects of present motive power. Data, illustrated by lantern slides, showing results obtained on electrified divisions of railroads were presented. Mr. Armstrong has recently made an exhaustive study of European railroad conditions and made a comparison between operating conditions in Europe and this country.

REPORTS TO BE MADE BY COMMERCIAL SECTION, N. E. L. A.

Bureaus and Committees Have Been Particularly Active During Past Year.

The following outline will be of interest as evidencing the exhaustive work done by various units of the Commercial Section, National Electric Light Association. The practical and valuable data thus secured will be fully reported at the annual convention to be held in May at Pasadena, Calif.

The Commercial Section sessions, which will be held on three afternoons of the convention, probably will be well attended by commercial men and officials of central stations, who will be attracted by the comprehensive reports to be submitted. The Commercial Section reports will also occupy a prominent place on the general session program.

The ELECTRICAL REVIEW published, in the issue of Jan. 31, 1920, a complete list of the N. E. L. A. committees of its Commercial, Technical, Accounting and Vehicle sections. The following outline covers the particular work of the comittees of the Commercial Section only:

OFFICERS OF COMMERCIAL SECTION.

Officers of the Commercial Section for 1919-1920 are as follows: Chairman, John G. Learned, Public Service Co. of Northern Illinois, Chicago; vice-chairman, M. S. Seelman, Brooklyn Edison Co., Brooklyn; secretary, R. H. Tillman, Consolidated Gas, Electric Light & Power Co., Baltimore; executive representative, A. Jackson Marshall, 29 West 39th street, New York, N. Y.; chairman of executive committee, M. O. Dellplain, Northern Indiana Gas & Electric Co., Hammond, Ind.

ADVERTISING AND PUBLICITY SERVICE BUREAU.

L. D. Gibbs, Edison Electric Illuminating Co. of Boston, is chairman of this bureau, which is working in close co-operation with all other standard forms of electrical advertising in an aim to make electric service the most desirable part of home equipment in the mind of every housewife. Educational advertising to promote the use of electricity industrially and commercially, as well as in the household, is being produced. The bureau is exerting special care to avoid duplication of effort and to constructively support other activities directed toward the same ends.

Adequate Outlets Division.—It is doubtful if any small item of electrical equipment finds a more favorable audience among users of service than does the outlet plug convenience plan. P. L. Thomson, Western Electric Co., New York, is chairman of this division, which is seeking to further increase the appreciation of the public of the convenience of adequate outlets in the wiring equipment of dwellings, apartment houses, hotels, etc. The division will assist in directing and co-ordinating previous efforts along this line to the end that all parties interested will think of what is needed in the way of outlets in order to secure the fullest service and comfort, rather than the minimum number with which they can get along.

General Commodity Advertisers Division.—Earl E. Whitehorne, 120 Broadway, New York, is chairman of this division, which has developed a new form of publicity of interest to the industry. Briefly, the members are carrying out a very comprehensive plan to have all advertising of whatever sort contain when possible the introduction of the electrical appliance idea in conjunction with subjects treated. This works out especially well in advertising of household goods, advertisements showing preparation of food products, etc. The response from advertisers and advertising agencies regarding this novel idea has been gratifying and the report of the committee will contain much that is of interest.

Co-ordinate Advertising and Sales Campaign Division.—A connecting link between the manufacturers advertising and the possible monthly sales campaigns of central stations and other distributors of electrical appliances. The chairman is Henry Harris of the Duquesne Light Co., Pittsburgh.

Illuminating Engineering—Non-Technical Applications Division.—P. B. Zimmerman, National Lamp Works of General Electric Co., Cleveland, is chairman of this division, the activities of which are being directed to secure a generally increased understanding of the science of illumination. The work is being presented in a strictly non-technical style, and the public is responding through contractor-dealers.

Motion Picture Film Division.—This division will assist other agencies in the work of encouraging the proper use of electrical appliances in moving picture scene settings. "Electrical illustrations" by scenario writers and animated cartoon artists will be promoted. Charles H. Pierson, Southern California Edison Co., Los Angeles, is chairman.

Newspaper Advertising Campaigns Division.—The much-discussed value of newspaper advertising will be covered in the report on this subject. With men of the type found on the list that makes up this division there will be brought out matters of vital interest to every dealer and contractor. The field covered includes continuous and, wherever possible, collective advertising of service and products; reports of development of co-operative plans between newspapers and electrical interests in the use of such advertising and reports on activities that have been undertaken in the past along these lines will be made. Mathias Turner, Cleveland Electric Illuminating Co., is chairman.

News Syndicate and Magazine Writers' Division.—This division, of which Frank B. Rae, Jr., 4500 Euclid Ave., Cleveland, is chairman, is promoting the popular attitude toward the use of things electrical through illustrators and magazine writers who have almost unlimited resources for inculcating the electrical idea into their work on a "human interest" basis. The division also seeks sources of supply for such material and information as may be asked for, and to make these sources increasingly available.

LIGHTING SALES BUREAU.

Clarence L. Law, New York Edison Co., is chairman of this bureau, whose function is to co-ordinate the work of the various divisions, subcommittees and groups incorporated within

it in collecting, analyzing and disseminating the latest and most authoritative data on the subjects as specified under their respective headings below. There are eleven geographic sections under individual consideration.

Division on Commercial Aspects of Lamp Equipment.—Sales methods and campaigns to dispose of the proper equipment to be used in all forms of illumination has occupied the attention of this division, of which George H. Stickney, Edison Lamp Works of General Electric Co., Harrison, N. J., is chairman.

Division on Industrial Lighting.—To fasten the interest of central stations in industrial lighting, to summarize data on all equipment available for factory, shop and similar lighting, and to present methods, sales arguments and experiences which have proved of value in promoting industry is the object of this division, of which H. H. Magdsick, National Lamp Works of General Electric Co., Cleveland, is chairman.

Division of Lighting of Large Buildings.—Sales methods and campaigns to illuminate the interior of churches, theaters, armories, school houses, hospitals, libraries, federal and municipal buildings, office buildings, railroads and steamship stations, halls of apartment houses, hotels, clubs, etc., will be reported by this division. G. Bertram Regar, Philadelphia Electric Co., is chairman. Several important groups within this division are carrying on investigations and gathering data for dissemination relative to these subjects.

Division of Residence Lighting.—C. M. Masson, Southern California Edison Co., Los Angeles, is chairman of this division, which will report on sales methods and campaigns to secure the use of electric service in residences. The division is divided into three groups, viz., large residence, apartment house, and small house.

Division on Store Lighting.—Sales methods and campaigns to secure the use of electricity in store and window lighting will be reported in this division, of which F. C. Taylor, Rochester Gas & Electric Corp., Rochester, N. Y., is chairman.

Division of Street and Highway Lighting.—Sales methods and campaigns to illuminate electrically the streets and highways of the country have constituted the work of this division, of which W. T. Dempsey, New York Edison Co., is chairman.

Merchandise Sales Bureau.

E. A. Edkins, of the Commonwealth Edison Co., Chicago, will report as chairman on the work of this bureau, which is co-operating with other committees of the association whose duties are somewhat related to that of the above. Analysis of existing merchandising practice and the compilation and recommendation of efficient methods of buying, stocking, displaying and selling electrical merchandise constitute the work of this bureau. Development of plans for co-operation and mutual helpfulness between the Commercial Section of the N. E. L. A. and other associations in the industry has been kept active.

Division of Electrical Merchandise.—F. D. Pembleton, Public Service Electric Co., Newark, N. J., is chairman of the division and subcommittees on stock, buying and cost of selling. The division will report on recent developments in electrical appliances, on their investigation of seasonable buying, market conditions, economies in purchasing, charge and expense items allocated by electric shops against cost of selling with recommendations, and will present a standardized schedule of fixed charges and expense items which may be properly chargeable to cost of selling electrical merchandise.

Electric Range Division.—Chairman J. Paul Clayton, Central Illinois Public Service Co., Springfield, Ill., is working with other members of the division to secure further popular appreciation of the use of the electric range. To this end its members have studied its greater development possibilities and will report on their investigation of methods. Authentic data on current consumption, diversity factor, operating costs, etc., will be presented.

Division on Present and Prospective Conditions of Central Station Merchandising.—Stanley A. Dennis, *Electrical Merchandising,* New York, is chairman of this division, the work of which is investigation and report on the economic condition of central-station merchandising, both present and prospective; analysis of the trend of state commission rulings and other actions taken by legislative or public bodies bearing on central-station merchandising; consideration of the value of central-station merchandising from the standpoint of good will and public policy.

Division of Electric Shop Management.—C. E. Greenwood, Edison Electric Illuminating Co. of Boston, will report as chairman the division's work in investigation of best methods in operating electric shops under varying conditions; recommendations on standardized methods for the organization and training of office, stockroom and sales force personnel; recommendations covering latest and best methods of electrical merchandise display; systematization of sales and statistical records, graphs, charts and reports necessary for the efficient supervision and management of electric shops.

Division of Standardization and Testing.—O. R. Hogue, Commonwealth Edison Co., Chicago, is chairman of this division, whose members have been making preliminary investigation as to the ultimate feasibility of securing co-operation betwen manufacturers of electrical appliances and the N. E. L. A. for the purpose of establishing some central authorized bureau to be recognized as an authority on electrical appliance standards; to prepare basic specifications covering the essential requirement of design, construction safety, etc., of electrical appliances in general, as a basis for further discussion and development of the possibilities of this plan.

Division of Research and Sales Promotion.—A general study of development of new lines and fields of business in appliances, also new sales methods and plans in their relation to best articles for merchandising, together with margins of net profits, is the work of this division, headed by Walter S. Byrne, of the Nebraska Power Co., Omaha.

Power Sales Bureau.

The object of this bureau is to develop as rapidly as possible the widest use of central-station

electric energy for all industrial and railway purposes, including lighting, power, heating, melting, refining and all process work. It is the aim of the bureau to maintain an organization by which this can be done with but slight duplication, and to provide effective means for disseminating data and information effectively. Robert H. Knowlton, United Gas Improvement Co., Philadelphia, is chairman.

Division on the Economies of the Use of Central-Station Electric Power.—John W. Meyer, of the Philadelphia Electric Co., heads this division, which is gathering data which the economy relative to our industry bears to the management of capital, labor and materials in construction and maintenance of equipment and in the production and distribution of goods, particularly with respect to economic phases of engineering and commercial activity in their relation to the sale of energy for industrial and isolated plants.

Electric Development Division.—Morse Dellplain, Northern Indiana Gas & Electric Co., Hammond, Ind., is chairman of this division, which is active in the study of new industrial electrical processes and of recommendations for presentation of addresses and papers before national manufacturers' association conventions on the application of central-station power.

Division on Electric Steel Furnaces.—The study of application of the electric furnace to the refining and manufacturing of steel and ferro alloys is being promoted by the members of this division, headed by Joseph McKinley, of the Duquesne Light Co., Pittsburgh.

Division of Electro-Chemical Processes.—C. H. McClure, of the Commonwealth Edison Co., Chicago, is chairman of this division, studying the nature and amount of load served by central stations at the present time and the most desirable applications from the central-station standpoint of its use in chemical and metallurgical manufacturing.

Division of General Power.—The application of central-station energy to the brick and clay industries with reference to its use in drying the product, and to the wood-working industry in the way of economic use of wood waste other than as fuel is the work of this division. The chairman is W. E. Murphy, Minneapolis General Electric Co.

Division on Industrial Electric Heating.—The application of central-station energy to nonferrous metal melting and refining, enameling and japanning, heat treating, welding and all heat processes, has the attention of the above division. N. T. Wilcox, of the Mississippi River Power Co., Keokuk, Iowa, is chairman.

Division on Irrigation, Water Supply and Sewage Pumping.—The application of central-station energy to these subjects will be reported on by this division.

Division of Isolated Plants.—J. B. Stuart, Public Service Electric Co., Elizabeth, N. J., will report as chairman on the economic study of isolated plants, their development and costs.

Division of Power Contract.—R. H. Ashworth, Utah Power & Light Co., Salt Lake City, is chairman of this division, which is studying the subject of the partial standardization of power contracts.

Division of Power Supply to Railways.—The problems arising in the application of energy to urban and interurban traction systems, and electrified steam railways are being studied by this division.

SPECIAL COMMITTEES OF COMMERCIAL SECTION.

Commercial Service and Relations with Customers.—The formulation of efficient methods of conducting relations between the customer, the public and supplying company, collections and credits, constitute the work of this committee, of which R. F. Bonsall of the Consolidated Gas, Electric Light & Power Co., Baltimore, is chairman.

Compensation of Salesmen.—This committee is studying the question of compensation of salesmen in order to determine points of relationship which compensation should bear to qualifications in performance of various classes of work, sales opportunities, and net sales. A. Hertz, of The New York Edison Co., is chairman.

Education.—Preparation and sale of educational correspondence courses to members companies and allied industries for the benefit of employes, is being worked out by this committee. Fred R. Jenkins, Commonwealth Edison Co., Chicago, is chairman.

Electrical Salesman's Handbook.—This committee is active in revision and preparation of the Hand Book and collection and distribution of data and information for same. The chairman is I. Lundgaard, Rochester Gas & Electric Corp.

Finance.—This committee has general jurisdiction over the finances of the Commercial Section, recommends necessary disbursements, analyzes proposed expenditures and reports on same to executive committe. The chairman is M. S. Seelman, Brooklyn Edison Company.

Sale of Company Securities to Customers and Resident Citizens.—The chairman of this committee is George R. Jones, Public Service Company of Northern Illinois, Chicago. The committee will investigate and report on the availability of commercial representatives for selling investment securities of the companies to the public, and the organization and development of methods towards this end.

Wiring.—This committee is working out plans for standardization and proposals for adoption of methods of wiring embodying safety, good appearance and low cost; creation of effective methods of selling wiring by contractors or central stations; standardization proposals in regard to connections from service to wiring and wiring to appliances. R. S. Hale, Edison Electric Illuminating Co., Boston, is chairman.

NEW YORK STATE SEEKS RIGHT TO SELL HYDROELECTRIC POWER.

Would Develop Electric Energy and Sell to Municipalities and Inhabitants at Cost.

Bills have been introduced in the New York State House of Assembly and Senate seeking to amend the Conservation law in relation to the development of hydroelectric power for the state. The proposed bills add to the present conservation law a section empowering the Conservation Commission to acquire, take over, possess, con-

trol and utilize the waters with in the state, and the boundary waters thereof appropriate for power purposes, and to develop water power therefrom, and to generate and develop therefrom electrical current, power and energy, and to transmit, distribute, sell or lease the same to the municipalities and inhabitants of the state at cost; to acquire by purchase, condemnation or otherwise, lands, building, plants or other necessary equipment; and to create and designate electrical zones within the state. Municipalities within such zones contracting with the Commission for electrical power are authorized to light the streets, highways, public buildings and other public places, or otherwise use electrical power or energy, and to sell electrical power or energy to persons or corporations within the limits of such municipalities, and to regulate the price to be charged therefor.

The powers granted to the Conservation Commission under this measure are to be exercised by it independently of any other commission or department, and the Public Service Commission is prohibited from fixing, modifying or regulating any rate or charge for electric power so supplied by the state to municipalities, corporations or individuals.

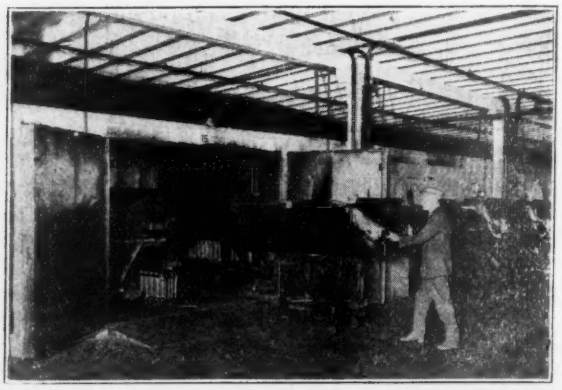
To carry cut the purposes of the act $250,000 is appropriated.

USE OF ELECTRICITY IN JAPANNING PROCESSES.

Discovery of New Japan, Applied by Electric Dip, Eliminates Danger of Explosions and Fires.

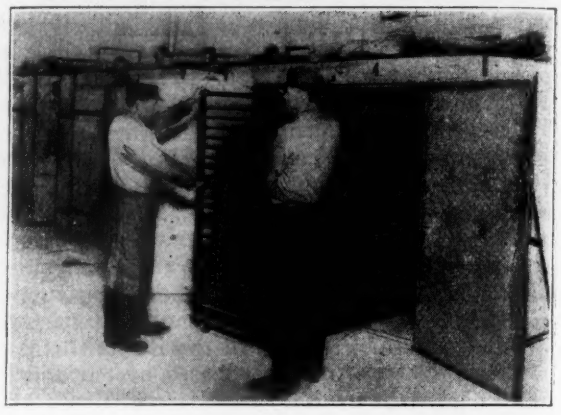
Baking japan as ordinarily used in manufacturing consists of two elements—the base and the solvent. The base is usually some variety of asphalt, combined with linseed or some similar oil, the whole making a hard substance of the appearance of rubber. This must be liquefied for use and the common practice is to dissolve it in naphtha or kerosene. The process of japanning various metal articles consists in dipping them in the liquid japan and then baking them in an oven.

Owing to the volatile and inflammable type of the solvents used this baking process is somewhat hazardous. After several bakings have been consummated, the atmosphere in the oven resembles that of the inside of a gasoline-engine cylinder, only needing a spark or even excessively high temperature to cause an explosion of great force.



Electrically Heated Japan Baking Oven at Chevrolet Motor Co., Tarrytown, N. Y.—Oven 20 Ft. by 18 Ft., and Connected Load 96 Kw.

This risk has been great enough to cause some of our large municipalities to consider requiring a manufacturer to not only isolate his oven buildings but to provide further protection in the form of a fire wall. It also seemed possible that the insurance companies might become interested to the extent of causing increased expenditures on the part of manufacturers who are large users of japan.



Battery of Four Electrically Heated Ovens for Baking Japan on Automobile Tags—Each Oven 8 Ft. Wide by 8 Ft. Deep by 6 Ft. High—24 Kw. Connected Load—Baking Temperature 225 Deg. F.

The manufacturers consequently became interested in the possibility of developing a type of japan which has a noncombustible solvent. The research laboratory of the General Electric Co. was requested to try and evolve such a product and a course of research on their part resulted in the development of a variety of japan which eliminated the necessity of a solvent possessed of the destructive propensities of the conventional kinds.

This water japan, as it is called, is an emulsion of the asphalt oil base with water. By this is meant that infinitesimal particles of the base are held in suspension in the water instead of being dissolved in it. It was found that this japan had no tendency to settle out, even after months of storage, and that, owing to its being "suspended" in water, losses by evaporation were practically negligible.

The methods of applying the japan are two in number—the electric dip and the hot dip. The former is appropriate for small articles and consists in placing them, charged positively, in a negatively charged iron tank of japan. The result is that an even, smooth coating of japan is deposited on the articles in question and, since the japan is deposited free from solvent, there is no resultant drip when the lot is conveyed to the baking ovens.

The second method, or the hot dip, which is applicable to large pieces of metal, was found more or less by chance. It had been the custom in the laboratory to preheat the metal before dipping, in order to free from dirt and grease. This preheating evidently had the same effect of causing the japan to form a deposit on the metal as giving it a positive electrical charge. A third method is also sometimes used which is a combination of the two already mentioned, the metal being both heated and positively charged.

Editorial Comment

Time for Plain Talking

What amounts to a virtual breach of faith on the part of the United States government towards investors in its war-time securities is a matter which seriously affects the raising of much-needed capital by members of the electrical industry, including public utilities, manufacturers, jobbers, contractors and dealers, and restricts the accommodations which bankers in this country are able to extend to them in the way of credits.

At present prices Liberty Loan issues show a shrinkage of roundly $1,250,000,000, compared with the price of par at which the government sold them to investors. The first issue, 3½% bonds, are quoted around 97; they hold this price because the income from them is not taxable. The Victory Loan 4¾% bonds sell around 98 because they are a short-term bond, and the 3¾ Victory notes sell at an equal price because of the limited taxation applying to them and the short term which they have to run before being paid off. But the 4 and 4¼% bonds are selling between 90 and 91½, except the third issue of 4¼s, which is quoted around 93.

There is no change in the security behind the bonds. It is not a matter of ability of the government to pay them off when due. It is a question of interest rates. With money lending at 6½% for commercial paper, representing the lowest charge for so-called legitimate business, Liberty Loan issues are only seeking an interest basis market level, with the added advantage of being a government security. The bonds that are selling around 97, as against 91 for the others, are still governed by interest considerations, since the tax exemption is equal to a higher rate of return.

The viewpoint of the bankers is perhaps more important because the market value shrinkage of their holdings affects their ability to lend money or extend credit. Their notion is that the interest rate on the bonds should be increased in order that the return be sufficient to warrant a price of par.

George M. Reynolds, president of the Continental and Commercial National Bank, Chicago, has reached the conclusion, from the bankers' standpoint, that general money conditions would be helped by the government increasing the interest rate on the Liberty Loan issues.

Mr. Reynolds, according to an interview printed in the Chicago *Tribune*, made the following statement:

> "The federal reserve banks have approximately $1,500,000,000 loaned on government bonds and treasury notes. These large holdings were forced upon the banks, especially the eastern banks that had to make subscriptions in order that district quotas might be met.
>
> "Now, due to the low rates of interest on the bonds, in proportion to the large amount of money borrowed by the government, the banks have not been able to distribute these bonds. They have thus been compelled to use them as collateral in order to have the use of a part of the capital invested in them.
>
> "Dissatisfaction with the low rate paid on government bonds is shown in the low market price. They have gone below 90 at times. The wage earner, and substantially every one, was forced to buy to the limit of capacity on the representation that the bonds would never depreciate. Few bondholders are now happy in their purchase. We have penalized even the poor for their patriotism. I believe every outstanding bond should be taken up and refunded on a 5% basis. This would bring every issue up to par, enable the eastern banks to distribute their large holdings and reduce to a great extent the present inflation."

Whether the remedy proposed by Mr. Reynolds is the one that ought to be adopted may, of course, be subject to debate. The fact remains, however, that this is a time for plain speaking and for definite action of some character to take the place of the present drifting policy of the government. The ELECTRICAL REVIEW will be glad to receive from its readers, who embody the substantial elements of the industry, any comments that may be helpful in opening up further discussions of the subject.

Selling Appliances on Part Payment

The market that exists for the sale of electrical appliances can be divided into two parts, according to the terms of the sale: the cash market and the installment market. Of the two, the cash market probably is the smaller. Accordingly, if an electrical dealer does business only on a cash basis, sales are restricted. This,

in turn, means that the market for the consumption of electrical energy is correspondingly restricted.

Credit selling is a method of obtaining market expansion for both the electrical dealer and the central station. Many electrical dealers fear to take the risks involved in credit selling. Others lack the capital necessary to finance such selling.

The electrical industry is peculiarly well qualified to engage in installment selling. Everyone using electricity for any purpose, except in isolated plants, is on the books of the central-station companies, which know their customers as credit risks and which can assure the payment of bills by refusing to furnish additional service. Most prospective customers for appliances are on their books. Their accounts must be carried and any additional items included in these accounts mean but little more work or expense.

Central-station companies, therefore, are in an excellent position to do a credit appliance business, adding the installments to the customers' monthly bills. They are also in a position to carry and collect the accounts of local electrical dealers.

Such arrangements will open up the full market for the sale of electrical appliances. People will be able to buy on credit from the many electrical stores. Each individual electrical dealer would then have a larger market and it would give him more reason to intensify his merchandising activities. The necessity of dealers keeping credit accounts would be eliminated. An increased market for the sale of electrical energy would be secured for the central-station companies and that would undoubtedly justify their action in assuming credit risks for the dealers.

Standardizing the Industrial Substation

The industrial substation has come to be quite a well-known affair, with the usual modifications to take care of each different central-station company and special conditions to be met with here and there. However, all in all, most every one knows the industrial substation, its purpose, what it comprises, and so on.

Standardization means, among other things, that the work of designing each installation, building each installation and keeping the necessary spares for each installation are all much simplified; operating the substations becomes a simple matter, since knowing the layout of one substation is to know the layout of all, with some secondary modification here and there. Basically and fundamentally, however, the substations are the same, and whether it be a machine shop, an ice plant or an electric furnace that is to be connected up, everything connected with it is simplified.

Standardization tends, perhaps, to dwarf growth, hinder improvement and encourage betterment. If this fact is borne in mind the danger in stopping progress and stifling evolution is largely eliminated, or to such an extent that the benefits of standardization far outweighs the possible disadvantages. The large industrial load is no longer the property of the largest utilities, some of the smaller ones now connecting loads representing quite an appreciable portion of their generating capacity. It is these smaller companies that have not as yet reached the point where they have had sufficient experience with industrial substations on a large scale to permit standardization. On the other hand, the conditions under which they operate are such that they will find the advantages of standardization of even greater moment than the larger companies.

Progress only comes from evolution, improvement from imitation. The smaller companies can do nothing better than to find out what the larger leading companies are doing and then apply this knowledge to their own conditions. In this way many of the smaller utilities can commence where the larger utilities longer in the game have left off. This will mean real progress and a very real gain.

Grounding of Electrical Circuits

Notwithstanding the fact that electricity brings much of convenience and utility to the public, it also brings, unless properly controlled, life and fire hazards of considerable moment. In the installation and operation of high-voltage circuits these hazards have been clearly recognized and necessary precautions taken to reduce hazards to a minimum. But on low-voltage circuits, where the danger of fatalities is not so great, more attention has been paid to obviating fire hazard than life hazard. The error of this attitude is coming to the top.

Evidence of this fact is shown by an article on the subject of grounding and polarization as protective measures, written by Mr. W. J. Canada, the first part of which appears in this issue. The entire subject has been summarized and conclusions drawn as to what circuits should be grounded, why they should be grounded and how. Mr. Canada is particularly well qualified to answer such questions, and his analysis of the situation and recommendations will undoubtedly be an important contribution to the safety measures which must keep step with the extensive developments of electrical devices and their uses.

Current Events

Super-Power Zone Chief Topic at A. I. E E. Mid-Winter Convention—Fixture Design Discussed—Exports Increase

DESIGN OF LIGHTING FIXTURES DISCUSSED IN CHICAGO.

Chicago Section, I. E. S., Hears Ward Harrison Expound Principles of Design With Special Reference to Gas-Filled Lamps.

The considerable attention just now being given to lighting fixtures following the recent Detroit convention of fixture and glassware manufacturers and dealers made very timely a discussion of design at the Feb. 19 meeting of the Chicago Section, Illuminating Engineering Society. The speaker was Ward Harrison, illuminating engineer, National Lamp Works, Cleveland, Ohio, and the title of his address, "Essentials of Fixture Design with Special Reference to the Type C Lamp." He first explained the principles of reflection, transmission and refraction of various glass and metal diffusers and reflectors and demonstrated their action by simple experiments. The utility of mirrored, opal and prismatic glassware, and of aluminum and porcelain-enamel metal reflectors in fixtures was thereby clearly shown. Mr. Harrison then took up industrial lighting fixtures, giving special attention to the recent development of the standardized line of R-L-M metal dome reflectors and their advantages in light distribution, adaptability, efficiency, etc. A large number of illustrations of installations were shown.

Requirements of commercial and office lighting fixtures were discussed and many recent types of these critically analyzed. Complete and practically hermetic inclosure of the lamp is a development now found highly advisable in order to keep dust out of the inside of the fixture and thus reduce the cleaning problem. Ventilation of ordinary fixtures is no longer necessary even with type C Mazda lamps; its elimination is actually found to be advantageous in reducing maintenance. A flattened inclosing bowl has advantages over a spherical one in distribution and glare reduction.

In residence fixtures Mr. Harrison said there was a rage at present in favor of candle designs, the displays at Detroit being preponderatingly of this type and correspondingly glaring. He showed possibilities in the use of novel and effective design types for dining and living rooms. Too much attention is now being paid to the period design fad; there is no more reason for making every detail of the lighting fixture conform strictly to the period design than there is for using an obsolete design of heating or plumbing equipment, or of hardware, window design, etc.

The subject was discussed by A. L. Arenberg, J. R. Cravath, W. A. Durgin, G. K. Severn, L. C. Spake, Mr. Murphy and Chairman F. H. Bernhard. Mr. Harrison closed the discussion by answering many questions and refuting some of the arguments presented by a few of the speakers. He dwelt especially on the opportunity of fixture designers and dealers of educating their patrons to select fixtures that meet the illumination requirements of different rooms. He did not believe patrons are so insistent on having their ideas carried out in fixtures as to prevent the designer and dealer from correcting manifest errors in the same from the illumination standpoint. In many cases the patrons are in advance of the fixture men in really trying to buy illumination effects and not merely a lot of fixtures. The proper use of the new white Mazda lamp was also explained by Mr. Harrison.

PACIFIC COAST SECTION, A. I. E. E., TO MEET IN PORTLAND, ORE.

Annual Convention Will Be Held July 21-23 With Large Attendance Expected.

The Pacific Coast Section of the American Institute of Electrical Engineers will hold its annual convention July 21-23 at Portland, Ore. The attendance will comprise delegates from Los Angeles, San Francisco, Portland, Seattle. Spokane, Salt Lake City and Vancouver, B. C. The Portland committees now active in preparing for the convention are headed by O. B. Coldwell, on program; C. P. Osborne, on publicity, and W. C. Heston, on arrangements. It is expected that several officials of the national association will attend. This is the centennial year of several notable inventions and discoveries in the electrical field, and it has been suggested that a session commemorating them be held.

CHICAGO LAKE FRONT IMPROVEMENT PLAN IS APPROVED.

All obstacles to the electrification of the Illinois Central railroad along the shore of Lake Michigan in Chicago and the $110,000,000 improvement of the lake shore for park purposes by the city of Chicago were removed last week when Secretary of War Baker signed the necessary governmental permit for the work.

Chicago voters on Feb. 24 authorized the issuance of $8,000,000 in bonds for the first three years of the improvement work. Among the early improvements by the Illinois Central railroad in connection with the electrification of the road will be changes in the Randolph street suburban station, which will be remodeled and entrances made for passengers by means of tunnels under Michigan boulevard, which is badly congested during the rush hours. Electrification

of the railroad company's tracks inside the Chicago city limits is expected to be completed within two years.

The first steps in the improved service will be the purchase of new steel cars that can be used in the electrified service. All of the electrification work will be in charge of A. S. Baldwin, vice-president of the Illinois Central railroad.

WISCONSIN PUBLIC UTILITIES SEEKING BIG LOANS.

The public utilities of Wisconsin are coming into the market for large sums of money for developing new properties, making improvements and extensions to existing plants and funding outstanding floating debts. The Railroad Commission has, in the past two months, authorized the issue of securities amounting to $2,734,400 and there are pending applications for $5,035,950. Of the total, $500,000 represents note issues, $1,499,000 bond issues and $5,771,350 is in the form of stock, either common or preferred. Issues involving $100,000 or more are as follows:

Peninsular Service Co., $100,000; Wausau Telephone Co., $160,000; Colfax Light & Power Co., $182,900; Peninsular Power Co., $250,000; Interstate Power Co., $272,800; Wisconsin Valley Electric Co., $350,000; Wisconsin River Power Co., $500,000; Big Falls Water Power Co., $1,000,000; Wisconsin Gas & Electric Co., $1,000,000; Eastern Wisconsin Electric Co., $1,200,000; The Milwaukee Electric Railway & Light Co., $2,133,700.

TAMPICO, MEX., NEEDS SUPPLY OF ELECTRICAL GOODS.

Tampico, Mex., has never possessed enough electrical goods to supply the demand, reports United States Consul Dawson, stationed in that city. This district embraces the world's most prolific oil belt, constantly under development and subject to daily improvements in all that accompanies such enterprises. The housing problem has been one of the city's foremost concerns during the past year and naturally the question of fittings has received attention. Electrical installation, wiring fixtures, electric pumps for supplying water, etc., have been factors occasioning delay in the fulfillment of building contracts.

A. I. M. E. HOLDS MEETING IN NEW YORK CITY.

The American Institute of Mining and Metallurgical Engineers held its 121st meeting in New York City, Feb. 16-19. In attendance, interest, number of papers and importance of papers the meeting was unique because of the careful selection of papers and the arrangement of program. The meeting will have an important effect upon the conduct of government affairs in the future and on the solution of the great economic problems that are confronting the citizens of the entire country.

The program for the meetings of the Institute included the business meeting, simultaneous sessions in which technical matters of interest were taken up, including discussions on oil, coal, industrial organization, taxation and ferrous and nonferrous metals.

Officers elected were Herbert Hoover, president; Edwin Ludlow, first vice-president; Henry S. Drinker, Frederick Laist, A. R. Le Doux, Seeley W. Mudd and Robert M. Raymond, vice-presidents; George D. Barron, treasurer; Bradley Stoughton, secretary, and Percy K. Barbour, assistant secretary.

ELECTRICAL EXPORTS IN 1919 SHOW 50% INCREASE OVER 1918.

Government Totals Show Gain of $29,106,105 in Total Exports of $89,089,711.

Electrical exports by United States manufacturers broke all records in 1919, the total for the 12 months being $89,089,711, against $59,983,606 in 1918, a gain for 1919 of $29,106,105, or approximately 50% on the year. The figures are obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., the figures for the month of December being given out at the same time. December exports totaled $6,665,660, a trifle lower than the average for the other 11 months of the year, which averaged about $7,500,000. The figures follow:

	December		Calendar year	
	1919.	1918.	1919.	1918.
Electrical machinery and appliances, except locomotives:				
Batteries .....$	477,102	$ 233,321	$ 5,998,337	$ 3,178,437
Carbons	100,946	139,347	1,391,765	1,600,920
Dynamos or generators	583,025	344,034	5,799,885	3,363,349
Fans .....No.	32,648	88,678	1,421,160	847,327
Heating and cooking apparatus	110,575	74,794	1,579,757	686,339
Insulated wire and cables ...	499,315	465,688	8,815,212	5,604,929
Interior wiring supplies including fixtures ...	245,434	100,270	2,319,498	1,428,615
Lamps—				
Arc .....No.	1,088	128	16,893	14,139
Incandescent—				
Carbon filament ..No.	16,678	13,809	202,590	102,872
Metal filament ..No.	311,308	229,903	4,674,317	3,369,192
Magnetos, spark plugs, etc.	232,762	318,005	3,034,775	2,749,705
Meters and measuring instruments	227,955	122,311	2,891,307	1,887,925
Motors	778,039	663,216	10,635,476	8,225,197
Rheostats and controllers ...	35,836	27,859	514,760	288,757
Switches and accessories	216,020	151,786	3,564,772	2,195,300
Telegraph apparatus, including wireless ..	41,767	68,090	830,887	378,806
Telephones	330,223	121,935	3,783,398	2,687,483
Transformers ..	297,869	195,180	3,787,851	3,528,673
All other	2,127,070	1,829,709	27,827,071	17,845,641
Total electrical machinery, etc.	$6,665,660	$5,188,054	$89,089,711	$59,983,606

In the following table are given the monthly totals for the 12 months of 1919, which show how the export movement fluctuated during the year:

Months (1919).	Electrical exports.		Electrical exports.
January .....$	6,722,524	July .....$	5,996,105
February	7,566,089	August	7,716,228
March	7,876,353	September	6,119,588
April	7,709,138	October	7,280,663
May	7,717,518	November	6,704,184
June	10,990,717	December	6,665,660

The yearly totals since 1912 is given in the following table:

1912 .....$	23,212,813	1916 .....$	40,244,075
1913	28,197,363	1917	55,478,079
1914	19,963,115	1918	59,982,526
1915	24,308,510	1919	89,089,711

Economical Power and Measurements Interest A. I. E. E.

New York Midwinter Convention Gives Special Consideration to Eastern Super-Power Zone and Higher Accuracy of Measurements

The eighth midwinter convention of the American Institute of Electrical Engineers, held in New York City on February 18 to 20, will rank in importance with any previous meetings of the Institute. Some of the papers presented will, in fact, be recognized as classics in electrical engineering and in other respects. The presidential address delivered by Calvert Townley, which was entirely nontechnical, will attract the attention of engineers by showing them that the society has many functions to perform other than those that consist in advancing the science and art of electricity. In that address President Townley discussed the feasibility of organizing a comprehensive society of engineers and the relation that should exist between the Institute and the new organization.

The general program consisted of the presentation of technical papers, entertainment for the members and guests, and inspection trips to the most important electrical industries in and about New York City. The companies who extended an invitation to the members and guests to inspect their properties included the American Telephone & Telegraph Co., New York Edison Co., Brooklyn Edison Co., Brooklyn Rapid Transit Co., United Electric Light & Power Co., Public Service Electric Co. of New Jersey; New York Central Railroad, Interborough Rapid Transit Co., and Electrical Testing Laboratories. The principal entertainment consisted of a dinner-dance at the Hotel Astor on Thursday.

The convention opened on Wednesday morning with registration by members and guests and a meeting of the Board of Directors. The principal question before the Board was the decision about the time and place of the next convention; the tentative choice is White Sulphur Springs, Va. During Wednesday afternoon many of the members, upon invitation, attended the convention of the American Institute of Mining and Metallurgical Engineers that was being held in the Engineering Societies building.

President Townley's Address.

President Calvert Townley opened the first session on Wednesday evening by the presentation of his presidential address. In this he said that the Institute is prosperous and that it is demobilizing and resuming its ordinary activities. He referred to the report of the Development Committee, which was presented at the June meeting, and to the frequent meetings that members of this committee have held with conferees from other societies. From these conferences the report of the Joint Conference Committee emanated, which has been approved by two other societies. He called attention to the fact that the Institute is not estopped from indulging in nonechnical activities, because the constitution provides that *among* the activities in which the Institute may indulge may be the reading of technical papers. It is difficult, even hazardous, to say that delegates authorized to participate in laying the foundation of a comprehensive society will actually establish a federated society, although he regards a federated or other similar body one of the most important questions before the engineers today.

The things that most need attention at the present are not altogether technical. For this reason Engineering Council has been organized. It is able and competent to consider nontechnical matters and interrelations between the different societies that must be worked out.

The Council has been of significant use to the societies in many ways. Among the things that it has done may be enumerated the finding of competent engineers for war service, co-operation with the Government to study war devices, creation of a free employment service, investigation of the compensation of engineers in government service, compilation of a model license law, co-operation with the United States Chamber of Commerce in collecting water-power data, furnishing of testimony on technical subjects before federal authorities, and the indulgence in many technical matters.

If a new comprehensive organization is created it cannot possibly include in its membership all of the engineers of the country. At present 50% of the engineers of the country belong to no organization whatever. To what extent the Institute should participate in a new organization is a question, because that organization will not adhere to technical subjects alone. At present the Institute does not cover thoroughly even the purely technical subjects in the electrical industry.

Following President Townley's address, Preston S. Millar, general manager, Electrical Testing Laboratories, New York, presented a paper on "Daylight Saving." Contrary to the belief of a great many people, Mr. Millar showed that the value of daylight saving is considerably overestimated. There is a question, in fact, whether or not it is not wasteful; it is found to reduce the total output of certain central stations, and of one gas company by about 3% during the several summer months. Reduction in output for lighting alone is found to average 8%. He estimates the annual saving by the public to be $19,250,000 for artificial light and 495,000 tons of coal. The principal advantages of daylight saving are the promotion of outdoor recreations and the saving of light and fuel. Economic losses probably outweigh its gains. Daylight saving legislation is class legislation.

In the discussion, R. S. Hale, Walter Slichter, Philip Torchio and W. J. Hoar agreed with Mr.

Millar's opinion; one or two other speakers disagreed with his views.

A paper by W. S. Gorsuch on "Essential Statistics for the General Comparison of Steam Power-Plant Performance" outlined a method for preparing statistical reports relating to power generation in steam power plants whereby comparisons can be made between the efficiencies of different plants. The method eliminates the necessity of making detailed studies of the thermal characteristics of several plants when their performance is being compared. This paper was reproduced in our last issue.

The paper by Edward J. Cheney, of the New York Public Service Commission, on "Standard Graphic Symbols," created considerable discussion. The essence of the opinions expressed seemed to be that such symbols would be desirable. Those now in use, which are the result of evolution, have no uniformity or agreement. It is desirable to standardize them as far as possible in order to afford simplicity and general usefulness, but it was suggested that the Institute undertake at present to standardize only those which are most generally used. A list of suggested symbols was presented. Mr. Cheney emphasized the fact that the given list may not contain the most desirable symbols and that there may be a difference of opinion about the form of the symbols. He said that he is not particular about their form but that he is particular about their adoption.

A. B. Smith, Walter Slichter and A. Maxwell suggested modifications of the symbols. Among others who participated in the discussion were P. G. Agnew, H. R. Summerhayes, O. C. Traver, L. M. Meckler and E. H. Martindale and others.

Symposium on Economical Power Supply.

The Thursday morning session was devoted to a discussion of the creation of a "super-power zone" or district extending from Boston to Washington, D. C., and covering several thousand square miles, in which practically all electrical energy would be generated in large power stations tied together by a system of transmission lines. The area suggested would include most of New Jersey, parts of Delaware and Maryland, the District of Columbia, eastern Pennsylvania, southern New York, Massachusetts, Rhode Island and Connecticut. The area would be served by a main transmission line extending roughly parallel to the coast from about Lawrence, Mass., to Washington, D. C., connected to three tap lines, one of which would extend into the soft coal fields, another one into the hard coal fields, and another to the Cedar Rapids on the St. Lawrence River. These tap lines and the main line would be fed by coal-burning stations and by hydroelectric plants placed at convenient points along the rivers in the area. This session was presided over by W. Le R. Emmet, consulting engineer, General Electric Co.

The conception of the super-power zone is W. S. Murray's. The increasing demand for power in this area, the difficulty of obtaining coal from the mines, and the large amount of waste that exists in small generating plants call for a unified power supply system that will make power economically available at all times and that will eliminate the tremendous waste that occurs at present.

Mr. Murray said that electricity is power's greatest agent. He asked the audience what would happen if iron were to lose its magnetic properties? He answered his own question by saying that 95% of all power equipment would need to be scrapped. The field of electricity has five main divisions, namely, the industries, the street railways, other transportation facilities, lighting, and miscellaneous. The average load-factor is at present not larger than 15%. By the development of the super-power zone, which he recommends, including a system of transmission lines connected to tide-water stations, power plants constructed near the coal mines and generating stations along the rivers, the load-factor can be increased to 50% or more. This means a three-fold increase at least, or a present useless waste of 66% of the energy generated. The number of pounds of steam used at present per kilowatt-hour is between 35 and 40. The installation of the system suggested will reduce the amount to about 15 lbs. A large amount of money will be required to install the system. But computations show that the return on the investment will be at least 24%. Moreover, the system will provide energy for the district for years to come. At present the New England States are using about 1,500,000 kw. The computations indicate that at the end of ten years these states will require 5,500,000 kw.

The new system will supply energy for 80% of the railway transportation that is now supplied by steam locomotives. This alone will result in a tremendous saving of coal, since the mechanical efficiency of locomotives will be increased 50%. Tests have shown that seven electric switch engines can do as much work as ten steam engines. One of the seven locomotives traveled 40,000 miles before it lost any time in being laid up for repairs.

Several members contributed papers to this symposium. They included W. L. R. Emmet, of the General Electric Co.; J. F. Johnson, Westinghouse Machine Co.; H. G. Reist, General Electric Co.; F. D. Newbury, Westinghouse Electric & Manufacturing Co.; W. B. Potter, General Electric Co.; Philip Torchio, New York Edison Co.; Percy H. Thomas, consulting engineer, New York City; W. D. A. Peaslee, Jeffrey-DeWitt Insulator Co., and O. A. Austin, Ohio Insulator Co. Besides these men, Prof. Malcolm MacLaren, Prof. Charles F. Scott, N. W. Storer, S. T. Dodd, D. B. Rushmore and J. W. Lieb presented contributions.

Professor MacLaren described a method by which the waters of the Susquehanna and Delaware rivers may be made to contribute largely to the energy used in this district. He showed that the present demand for energy is exceeding the supply and that the present plants cannot supply the demand. By utilizing the fall in these streams a large amount of energy can be produced at a relatively small cost.

Professor Scott said that the realization of this super-power zone is not far off. If industry is to make progress the zone must be created soon. Ordinary industry doubles every 13 years, but the electrical industry has doubled during the past five years.

Percy H. Thomas, who discussed the matter of transmission lines for the system, presented a plan for their construction that contains numerous innovations. The plan is inexpensive, relatively speaking, and is adequate. It calls for three lines of three cables each, each set of three conductors placed in a horizontal plane about 20 in. apart. By permitting the conductors to slide freely in their saddles and by attaching them rigidly to spacing bars placed near the centers of the spans, the danger of destroying the towers when a conductor might break is eliminated.

Philip Torchio's discussion showed conclusively that, with the water power of the country fully developed, there would still be an enormous field for the steam-driven central stations. Water-power development should not be delayed. But the total water power of the country when developed will be only a small part of the power that is consumed. The heat value of the water power in 1915 was only 8% of the total power used during that year. After all is said, this country must depend principally on coal for its energy.

Central stations are today the principal conservationists. If all coal-using industry in the nation were as economical of its fuel as the central stations are, a great saving of fuel would be effected. By electrifying industry, railways included, only one-third of the present shipments of coal would be necessary. Wherever the new central stations are built, they must be built and interconnected in such a way that continuity of service will not be jeopardized. When water-power projects are developed, they should be dedicated to the production of power for industries that require continuous and nonfluctuating service.

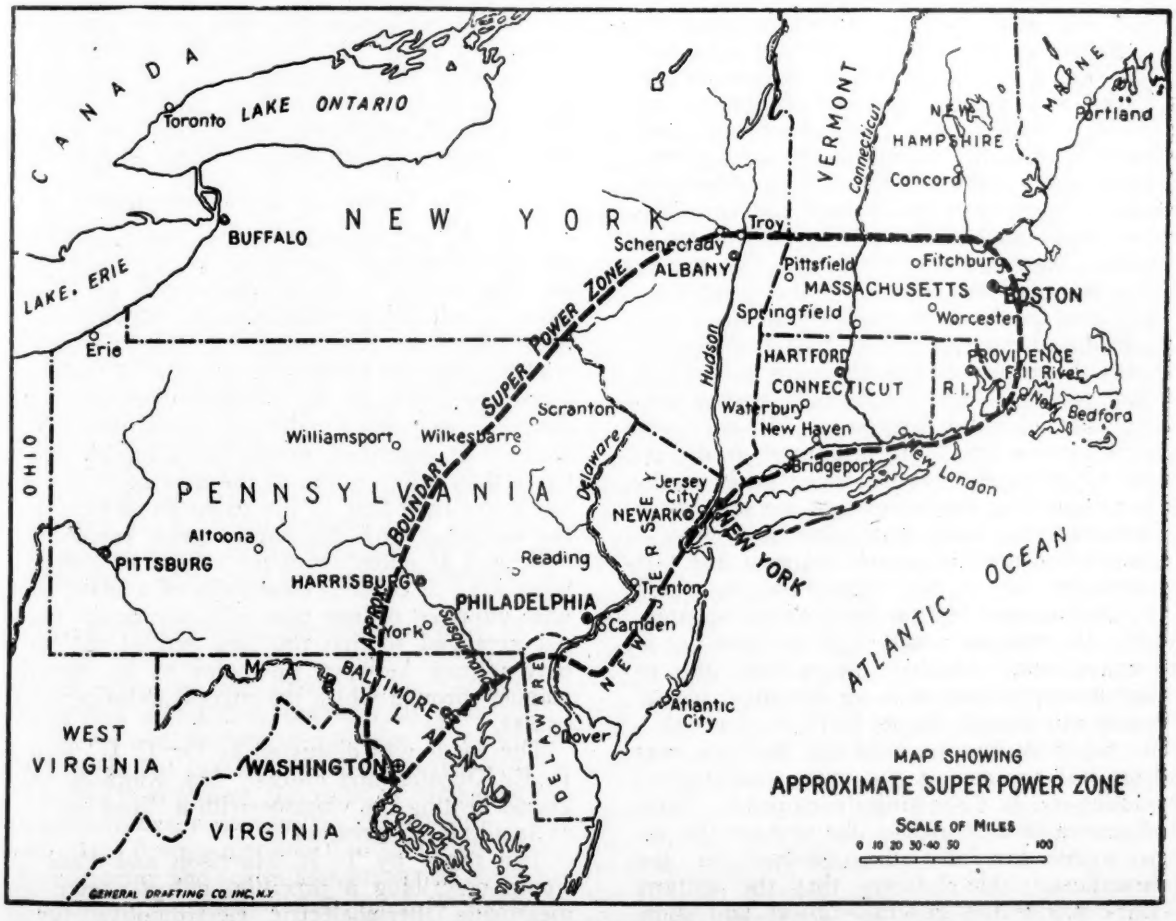
The point was brought out by several speakers that the main source of water power in this country is in the western states. For this reason the eastern states must, of necessity, derive their power from coal-using central stations.

J. W. Lieb and other speakers emphasized the necessity of adopting uniform equipment. If this super-power zone is established, its establishment will mean that common voltages and frequencies must be adopted. For instance, during the war, New York City was oversupplied with electric energy at 62½ cycles to the extent of 100,000 hp. At the same time Jersey City, directly across the river, had a deficit of a similar amount, but of 60-cycle frequency. As a consequence, New York City was unable to supply the deficit in Jersey City without going to some expense in altering equipment.

Electrical Communication and Measurement Methods.

Two parallel sessions were provided for Thursday afternoon. In one of these, papers were presented on printing telegraph systems and on output networks for telephone substation and repeater circuits. In the other session papers were presented on a method of separating no-load losses in electrical machinery, on inherent regulation of d-c. circuits, and on measurements of projective velocities.

The paper on printing telegraph systems was



Map Showing Proposed Eastern Super-Power Zone.

presented by J. H. Bell, of Western Electric Co. The paper described several systems and their methods of operation. In discussing the operating features of the systems described, the author considered the following headings: accuracy, speed of service, operating output, maintenance, line extensions and flexibility. The systems which are described are designed to handle traffic at more than 100 words per minute.

The paper on output networks for telephone circuits was presented by G. A. Campbell and Ronald M. Foster, of American Telephone & Telegraph Co. Ideal telephone substation and repeater circuits were shown to present output and input requirements which can be met by a type of circuit containing four resistances. Maximum output was found to involve biconjugacy; that is, the four resistances fall into two pairs without active electrical connection between the two resistances of either pair; all circuits maintain these requirements with the minimum number of elements enumerated. The necessary formulas for proportioning these circuits and also circuits having superfluous elements were derived.

Those who discussed these papers included Generals Squier and Russel, C. E. Davis, H. A. Emmons, P. M. Rainey, J. P. Edwards, E. R. Shute, R. E. Chetwood, O. B. Blackwell and John H. Cuntz.

The three papers presented at the other parallel session included one by C. J. Fechheimer, of Westinghouse Electric & Manufacturing Co., describing a method of separating no-load losses in electrical machinery; one by A. L. Ellis and B. W. St. Clair, of General Electric Co., on inherent regulation of d-c. circuits; and one by P. E. Klopsteg, of Leeds & Northrup Co., and A. L. Loomis, formerly major, Ordnance Department, U. S. A., on measurements of projectile velocities. Mr. Fechheimer explained a simple method for separating no-load losses. In applying the method, tangents are drawn to the parabolic curve at two points, and from the slope of these tangents the voltages and watts at the points, the exponent of the core loss curve, the core loss, and the windage and friction may be calculated from the derived equations.

Vladimir Karapetoff stated that the method is applicable only when the exponent is constant and that Mr. Fechheimer's formula applies best to a-c. machinery of large size. It does not apply accurately when the machinery is direct-current or is small. He described other methods for separating the losses that, he said, were perfectly general and that eliminated errors. Some of these methods are in common use. It was brought out in the discussion, in which W. F. Dawson and Walter Slichter participated, that Mr. Fechheimer's method is not new but is very convenient. Another new method of separating no-load losses will be described in the February number of the A. I. E. E. *Journal*.

The paper by Messrs. Ellis and St. Clair was read in full because of the impracticability of abstracting it. In discussing this paper V. Karapetoff stated that he would like to have the six cases more carefully distinguished in the Transactions. He believes that the authors should consider the general subject and show that the six cases are special instances of the general principles. He believes that this is a better rule to follow in presenting papers before the Institute, although he observes another rule in presenting similar subjects to students.

H. R. Summerhayes stated that the methods brought out in the paper have a practical application in the case of small plants where the sudden application of loads is relatively large. This is indicated where elevators cause lights to flicker. It was stated that a rule-of-thumb method permits the sudden application of one-sixth of the load on a d-c. generator without causing flicker.

The paper on the measurement of projectile velocities described the method and apparatus perfected during the war for measuring the velocity of projectiles from large guns. The success of the method is shown by the fact that the speed of testing was increased from 600 shells per annum to 500 shells per day at the time of the armistice. The essential parts of the apparatus consist of two targets, through which a shell passes, connected by a circuit to an apparatus back of the gun. The two targets, which were at first made of wire, were finally constructed of parallel sheets of tin or tin foil, separated by parafine paper for insulating purposes. When a shell passes through a target it causes a short-circuit.

The recording apparatus consists of a revolving drum around which a piece of blue paper soaked in parafine is wrapped. A short-circuit in the system causes a spark that melts the parafine and leaves a blue spot on the paper. Since the speed of the paper is known, the distance between the blue spots gives the time-interval elapsed while the shell passes from one target to another. In this way the average speed of the shell between targets can be computed, since the distance between the targets is known. This method, which was evolved by the writers of the paper, was put into use by all of the allies.

New Forms of Galvanometers.

P. G. Agnew, secretary of the American Engineering Standards Committee, began the Friday morning session with the description of a new form of vibration galvanometer. Such instruments have not been used extensively in industrial laboratories heretofore because of their extreme sensitiveness to external vibrations and their requirements for delicate adjustments. The instrument described, which has a higher sensitivity than other forms of the moving iron type but lower than that of the moving-coil type, has the advantage of sturdiness, quick responsiveness, and freedom from the effects of external vibration. It consists essentially of a small steel wire mounted on one pole of a permanent magnet arranged so that the free end of the wire may vibrate between the poles of an electromagnet through which the current to be detected passes.

The paper was discussed by Dr. C. H. Sharp, P. E. Klopsteg and others. Mr. Klopsteg suggested heating the vibrator with a direct current to facilitate observation.

The paper by T. R. Harrison and Paul D. Foote describing a precision galvanometer for measuring thermoelectric electromotive forces was read by H. B. Brooks. The principle in-

volved in the new instrument is one whereby an ordinary millivoltmeter may be converted into an instrument in which the usual errors arising from a variable line resistance are entirely eliminated. The instrument measures true electromotive force in a simple circuit or, if connected across a resistance or network through which a current flows, it indicates the potential drop just like a potentiometer. There is no loss in precision of setting results; in fact, the adjustment may be made to 10 times the scale accuracy. Dr. J. B. Whitehead, in the discussion, stated that this is a new combination of instrument and circuit that engineers will appreciate. Dr. A. E. Kennelly mentioned the fact that ordinary instruments affect the circuit into which they are introduced. This instrument, however, does not. The subject was also discussed by E. D. Doyle, C. H. Sharp and H. B. Brooks.

In their paper entitled "Notes on the Synchronous Commutator," J. B. Whitehead and T. Isshiki presented a theoretical discussion of the measurement of crest values of high alternating voltages. They showed that under certain conditions serious errors in the observations may occur. They studied the magnitude of the errors for a number of different connections and pointed out methods for eliminating them. An appendix to their paper gives a theoretical analysis of two cases investigated in which theoretical values show a close agreement with the experimental observations.

The paper was discussed by P. G. Agnew, C. E. Dorr, A. E. Kennelly and J. H. Morecroft.

Oscilligraphs and Measurement Accuracy.

Two papers were presented at the Friday afternoon session. One by A. E. Kennelly, R. N. Hunter and A. A. Prior described a new method of calibrating oscillographs; the other by H. B. Brooks was a compendium on commercial testing instruments. These papers elicited a spirited discussion that brought out new ideas not included in the papers.

The substance of the former paper was the description of a method whereby an oscillograph can be tested and calibrated by means of an auxiliary vibrator, or oscillographmeter. The two instruments are made to produce Lissajous optical figures whereby the resonant frequency of the tested oscillograph may be ascertained. From this and one other test, which is preferably a comparative calibration at 60 cycles and at the resonant frequency, the bluntness of resonance of the oscillograph is obtained. B. W. St. Clair and N. E. Bonn discussed the paper. Dr. Kennelly emphasized the fact that the matter in the paper applied to sustained oscillations only.

Mr. Brooks' paper was a careful discussion of instruments, their use, and accuracy. A large amount of attention was given to the various conditions that affect the accuracy, since accuracy is, in the end, the prime requisite. One of the most important parts of an instrument is the scale. If this is defective, the value of the whole instrument, however carefully constructed, is nullified. Mr. Brooks mentioned different methods of graduating the scales and presented some curves showing the relative degree of accuracy of observation taken from the different scales. The sources of error in electrodynamic wattmeters were discussed in the paper, and the principal factors affecting the accuracy of wattmeters presented. Methods and means of improving the quality of instruments were discussed.

That the paper was regarded as important was indicated by the large amount of discussion that it inspired. Those who discussed it included W. H. Pratt, J. R. Craighead, E. P. Peck, F. V. Magalhaes, F. H. Bowman, H. H. Sticht, B. W. St. Clair, A. L. Ellis and H. P. Sleeper.

HYDROELECTRIC PLANTS IN WEST FEAR LACK OF WATER.

Light Snowfall on Pacific Coast Shows Importance of Storage Basins to Obviate Low Water for Power Plants.

The snowfall has been unusually light the past winter in the Sierra Nevada Mountains of California and in the Cascade Range in Oregon and Washington, which presages a correspondingly greater low-water period for hydroelectric plants next summer, and for some districts a water shortage for irrigation purposes. In a few instances, however, provision has been made to minimize the effect of such shortage by creating storage basins which hold the flood waters of early spring months. But in many other cases the volume of storage water is very limited.

The Long Lake storage of the Washington Water Power Co., in the vicinity of Spokane, is probably the most important in the Northwest, aside from the storage basins in Montana; but the Long Lake storage is derived from the headwater region of the Columbia River, and not from the Cascade Range. The lake taps storage, from which water is supplied to the White River hydroelectric plant of the Puget Sound Traction, Light & Power Co., on the western slope of the Cascade Range in Washington, is no doubt nearly equal to Long Lake as a storage reservoir.

The dam on Skagit River, the construction of which will be begun in March this year by the city of Seattle, will produce a reservoir capable of great storage capacity. The glaciers at the base of Mt. Rainier, in Washington, constituting the sources of the White and Puyallup Rivers, produce in them a more or less constant flow, which is often made torrential by heavy rains. Other storage basins in the region of Puget Sound are possible of development, both in the Cascade and Olympic Mountains.

In southwestern Washington, where the runoff is rapid, the summer supply of water depends much upon early snow packed in mountain gulches, and in that region there is only limited opportunity for storage above power sites. In Oregon the same conditions exist to a considerable extent, although there are several mountain lakes that would afford ample storage for water power, but which are undeveloped.

In California the greatest natural storage reservoir is that of Lake Tahoe, situated at a high altitude in the Sierra Nevadas, but its outlet is the Truckee River that flows easterly into the state of Nevada, and thus far the electric power developed on that stream is transmitted

to Nevada towns and mines. Usually the snowfall in the Sierra Nevada Range comes early and is packed to great depth in the mountain recesses where some of it is held till after midsummer; but when the snowfall is far below normal, as seems to be the case the past winter, the water shortage becomes critical between July and September.

ONE EXAMPLE OF PROBLEMS FACED BY UTILITY COMMISSION.

When the City of Chicago ordered elevation of the tracks of the Northwestern Elevated railroad in Chicago north of Wilson avenue—nearly five miles of new construction—the problem was to keep rapid transit going and unimpaired while the work was in progress. This necessitated expenditures for temporary work in the form of trestles amounting to approximately $500,000.

All evidence of this expenditure will disappear upon completion of the elevation work, except for its inclusion in the accounting statistics of the company. It is "invested capital" but will be entirely invisible. Had the investment for this temporary work not been made, the road north of Wilson avenue would have had to close down while the elevation program was in progress and thousands of persons would be cut off from their only means of transportation to the city. This is a sample of the factors which the Public Utility Commission must take into account when fixing utility company rates and which the uninformed layman often fails to understand, commonly calling it "watered" capital.

ELECTRIC CLUB OF PHILADELPHIA ENTERTAINS SERVICE MEN.

The Electric Club of Philadelphia entertained about 300 men of the electrical industry who saw service in the world war at a dinner in Philadelphia on Feb. 19. Edward J. Cattell, of Philadelphia, was the speaker of the evening, while Washington Devereux acted as toastmaster.

WOULD PROHIBIT METER RENTALS.

An amendment to the New York State Transportation Corporations law has been introduced in the New York State Senate and Assembly prohibiting electric light corporations from charging or collecting rent on electric meters, either directly or indirectly, under penalty of $50 for each offense. An existing law prohibits a rental charge for gas meters.

PLAN WATER POWER MERGER.

In connection with the proposed Susquehanna river water-power development, controlling interests connected with the Susquehanna Power Co. and the Susquehana Water & Power Co. are arranging for the merging of the two corporations with a number of other enterprises in Pennsylvania and Maryland, including the Pennsylvania Water & Power Co. operating a large hydroelectric plant at McCalls Ferry, Pa. It is said that the proposed merger is to insure the construction of a new hydroelectric plant on the Susquehanna river, to be located in the vicinity of Conowingo, Md. J. E. Alfred, New York, chairman of the board of the Consolidated Gas, Electric Light & Power Co., of Baltimore, and Bertron, Griscom & Co., Inc., 40 Wall street, New York, are interested in the project.

ELECTRICAL MEN URGED TO TAKE INTEREST IN CIVIC AFFAIRS.

At a meeting of the New York Electrical League held at the Hotel McAlpin, New York City, on Feb. 18, ex-Congressman F. H. La Guardia, president of the Board of Aldermen, New York City, in an address to the 200 members and guests present, urged that men of the electrical industry pay more attention and take more interest in civic affairs of their different municipalities.

CONFERENCE CLUB TO HOLD MEETING IN CLEVELAND.

A one-day meeting of the Conference Club has been called by the executive committee for March 18at Cleveland, Ohio. The business to be considered will include fixing the time and place of the May meeting and making arrangements for a draft of the new constitution. The executive committee did not take action on these matters at the meeting of Feb. 20 because of the desire to hear the expressions of opinion from as many members as possible.

COMING CONVENTIONS.

American Electrochemical Society. Annual convention, Boston, Mass., April 7-10. Friday, April 9, joint session with American Institute of Electrical Engineers on "Electrically Produced Alloys." Secretary, Joseph W. Richards, Bethlehem, Pa.

American Association of Engineers. Annual convention, St. Louis, Mo., May 10 and 11. Headquarters, Planters Hotel. Secretary, C. E. Drayer, 63 East Adams street, Chicago.

National Electric Light Association. Annual convention, Pasadena, Cal., May 18-21. Headquarters, Hotel Huntington. Acting secretary, S. A. Sewall, 29 West 39th street, New York City.

Ohio Electric Light Association. Annual convention, Cedar Point, Ohio, July 13-16. Secretary D. L. Gaskill, Greenville, Ohio.

Pacific Coast Section, American Institute of Electrical Engineers. Annual convention, Portland, Ore., July 21-23.

National Association of Electrical Contractors and Dealers. Annual convention, Baltimore, Md., Oct. 6. Secretary, W. H. Morton, 110 West 40th street, New York City.

MASSACHUSETTS "TECH" STUDENTS ISSUE NEW MAGAZINE.

Tech Engineering News, edited and published by undergraduates of the Massachusetts Institute of Technology, has made its initial appearance as a magazine of 16 pages, filled with interesting matter on engineering and kindred topics. The purpose of the magazine is to keep the students informed of recent developments in engineering and to provide a medium for the exchange of ideas between the members of the Institute and the alumni.

Commercial Practice

Standardization of Farm-Line Construction — Central Station to Co-operate with Dealers in Sales Campaign

IOWA SECTION, N. E. L. A., SEEKS FARM-LINE STANDARDIZATION.

Committee Makes Preliminary Report Following Detailed Study of Conditions.

Following a detailed study of farm-line conditions the Iowa Section, N. E. L. A., Farm-Line Committee has compiled a preliminary report on the standardization of such lines for submission to the June meeting of the Section, where it will be subject to revision.

In the report it is recommended by the committee that each farm line be treated as a wholesale consumer when possible and that 25 kv-a. be the smallest substation tapped in on 33,000, 16,500, 13,200 and 11,000-volt lines.

It is the view of the committee that all farm lines outside of incorporated towns should be the property of the farmers, to be operated and maintained by them. To simplify this matter, sample articles of incorporation, notice of incorporation and method of petition to the Iowa Board of Railroad Commissioners for a franchise to erect and operate transmission lines are included in the report.

Standard minimum requirements for farm-line construction was made the subject of detailed study, the specifications calling for rural service lines of good sound material constructed in workmanlike manner. Poles, cross-arms and hardware are to conform to a standard practice and insulators are to be of a good grade of brown porcelain similar to those regularly used by the operating companies of Iowa. Lightning arresters are to be graded shunt, multigap or low equivalent type.

It was the general opinion of the committee that a service charge plus a small rate per kw-hr. for all energy is the ideal rate, but definite figures were postponed until more data is available showing losses and power factor of farm lines.

BUILDING DISPLAY AND PRESS CAMPAIGN INCREASE DEVICE SALES.

Toledo Railways & Light Co. Uses Big Electrical Display to Promote Publicity.

One of the most significant indications of the rapidly broadening field of activity on the part of light and power companies serving municipalities is the widespread adoption of the policy of selling electrically operated household utilities to their regular customers. Selling electrical devices to increase consumption of electrical energy is not an entirely new phase of power-current salesmanship, but the amazing increase in their variety, the diversity of their uses and the growing demand for them has made their distribution important not only as a means of increasing current consumption but from the direct profits involved in their sale.

An excellent example of the sales and advertising methods used by such producers was the building and window display recently made by the Toledo Railways & Light Co. to advertise electric utility devices. As shown in the illustration herewith, the upper half of the company's

Toledo Railways & Light Co. Building Illuminated to Advertise Electrical Devices.

building was festooned with illuminated vines and flowers.

In the different show windows were placed the leading devices sold by the company, novel and separate designs being used for each one. As the building is located in the heart of Toledo's business district, the unique and compelling display attracted much attention.

LARGE NUMBER OF FARM HOUSES ELECTRICALLY EQUIPPED.

Survey Made by Students of Iowa Agricultural College Show Almost Half of Homes in Large Township Have Electric Service.

The relation between education and home improvements on farms has recently been shown by several surveys made by different agricultural colleges, the surveys showing that the proportion

of home improvements steadily increases with education.

A study of all the farm homes in one large township in Blackhawk county, Ia., made by the Iowa Agricultural College, showed that half of all the farm houses in the township had furnaces, while the proportion having electric or gas lights, running water and baths was slightly less. Nearly half of the homes had such labor-saving devices as vacuum cleaners, power washers and electric irons. Nearly all these homes had telephones.

This is not a picture of the average conditions in farm homes throughout the United States, but is a picture of a condition somewhat exceptional at present to one to which the country at large is rapidly approaching. Each home improvement calls for others.

For example it is the general experience of distributors that the purchase of electric power service is followed by the purchase of a considerable amount of better furniture and furnishings. Better wall paper is required. More paint and varnish are used. When the electric lights are turned on, the rugs, the furniture and other house furnishings, which seemed satisfactory when kerosene lamps were in use, are not now so attractive.

The electric power service makes it far easier to have a water system in the farm house, with indoor toilet and bath, and have the water system 100% efficient. The power washer, the electrically operated ironing machine, the vacuum cleaner, the electric iron, and the electric fan can be utilized. The water can be pumped, the churn can be operated, the grindstone turned, the operations performed in and about the farm home by electrical energy.

The installation of a water system and an electric service raises the standard of sanitation in the farm home. More soap and cleaning compounds of all kinds are used, and greater pride in personal appearance is stimulated, leading not only to a demand for better clothes, but for other things that are found essential by the well-groomed man or woman.

CONTRACTORS AND CENTRAL STATION IN SALES CAMPAIGN.

Chicago Dealers and Contractors Unite with Commonwealth Edison Co. in Advertising and Sales Campaign on Electrical Appliances.

A committee from the Chicago Electrical Contractors' and Dealers' Association is co-operating with a committee from the Commonwealth Edison Co., Chicago, with a view to inaugurating a summer campaign to promote the sale of electric household appliances.

The success of some of the electrical dealers in Chicago can be made general in the opinion of the leaders in the movement. The methods used successfully in the past will be further improved and put in practice uniformly, thus coordinating and increasing the value of the different features of the project.

An association design for labeling and window use is being made up. Its use will signify that the dealer displaying it is a member of an organization seeking to stabilize prices at a moderate figure, to co-operate in general publicity work through street car and other advertising mediums, and that the dealer is a member of an organization equipped to sell on the deferred payment plan.

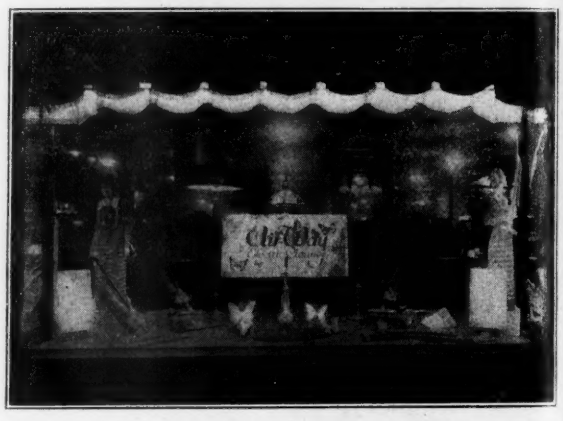
One of the most important features of this working arrangement between the Chicago Contractors' and Dealers' Association and the Commonwealth Edison Co. will be the assumption by the latter of responsibility for the collection of the deferred or installment payments. This will be done by adding the monthly payment to the monthly bill for electrical energy. Arrangements have already been made for the accomplishment of this plan.

Inasmuch as Chicago is a miniature of the whole nation, containing as it does representative neighborhoods and trade conditions of every type, the coming campaign will no doubt be watched by dealers outside Chicago with interest.

The date for the opening of the campaign has not been given out, but its duration will probably exceed six months.

LIGHTS AND LIFE-SIZE FIGURES MAKE "AIR-WAY" DISPLAY.

Use of life-size cutouts of women and actual living room furniture made a window display of "Air-Way" electric cleaners by the Toledo Railways & Light Co. one that attracted a lot of attention and comment. The fact that the whole



Window Display of Electric Vacuum Cleaners in Toledo.

building was decorated and illuminated at the same time added to the effectiveness of the window display. In connection with the display an impressive campaign of newspaper advertising was carried on to reach people whose business carried them only infrequently to the shopping district of Toledo.

BOSTON EDISON APPLIANCE SALES SHOW BIG INCREASE.

The appliance department of the Boston Edison Electric Illuminating Co. had its banner year in 1919 when gross sales reached approximately $340,000. This figure naturally surpassed that of 1918 when, owing to the dropping off of sales due to the World War, the total was only $187,000. The real comparison of the volume of business is made on the 1917 total of $250,000, which was the record-breaker up to that time. Last year exceeded this figure by $90,000.

Contracting-Construction

Soldering Cable Lugs—Banking and Contracting—Safety Switches—Second Installment of Proposed Code Changes

HINTS FOR EFFECTIVELY SOLDERING CABLE LUGS.

By L. W. Wyss.

The electrician will find that some asbestos heat-insulating paper is very convenient to use when soldering is done in close quarters. The paper may be used to protect insulation or any other material from the flames of a torch or from the soldering iron.

A great majority of electricians are very particular to see that lugs or cable terminals are filled with solder, even going so far as to pour additional solder to make up for the contraction when cooling.

A more important consideration often neglected results from using lugs much larger than the cable. These conditions often cause the solder to melt when carrying heavy currents because of its higher resistance and lower melting point as compared to copper. In other words, it should be understood that the solder is used to bond the cable close to the lug and not to carry current for any appreciable distance. When large lugs are used the cable strands may be spread or doubled in such a manner that the copper-to-copper space will be a minimum.

Dipping lugs in water to cool them is objectionable as the solder is cooled too fast and may become cracked or brittle, unless the dipping is done with caution. A wet rag is not considered so harmful, as the cooling is much slower than when the lug is submerged in water.

If there is much pulling strain on the cable, it is a good idea to drill a hole through the lug and cable for a small bolt or pin.

THE BANKER AS AN AID TO THE CONTRACTING BUSINESS.

Some time ago a large New York contractor who had always kept a good balance in the bank found it necessary to borrow a considerable sum in order to finance a large contract upon which he wanted to bid.

He applied to this bank for a loan, expecting no difficulty in securing it. The bank, however, hesitated. It knew him as a depositor. It did not know him as a borrower. The bank wanted to investigate first. The time was short and the loan was not granted in time to enable the contractor to secure the work.

This contractor's financial standing was good, as was also his integrity, but he never foresaw the necessity of obtaining a large loan. He had not taken occasion to use his banking connections to their fullest extent, assuming an independent attitude. He was late in learning his lesson.

Let us analyze the contractor's business, and see what he lost by failing to accept friendly aid of his bank sooner. It has already been said that the bank knew him only as a depositor. It had no knowledge of his business judgment or ability except in one way. It knew how his bank balance fluctuated from time to time, now high for months and then small for another period of months. The fact that this contractor's balance was often large a considerable length of time showed a lack of business foresight. This large amount of money was standing idle for months. The depositor received no benefit from it and the bank did derive some benefit. A large part of this money should have been working for the contractor. He could have invested it in various ways and borrowed from the bank when he needed greater liquid funds. It would have paid him to do so. Being independent of his banker meant that he wasn't using his money to the fullest advantage. The bank knew it. It knew he wasn't showing good business judgment and hence hesitated in granting the loan. His judgment might again be poor. The bank may have been the loser. It could not afford to take the risk without making an investigation.

ACTION ON SAFETY SWITCHES MAY BE DEFERRED.

In view of the interest taken in the movement to make use of safety switches mandatory for motor circuits where exposed to employes untrained in electrical matters, the recent action of subcommittees of the Electrical Committee, N. F. P. A., in charge of revision of the National Electrical Code, is of much interest at this time. A technical subcommittee was asked to consider this matter and recommended that a sentence be added to Rule 8*c*, which deals with motor cutouts and switches, as follows: "All switches used for this purpose must be of an approved externally operated enclosed type arranged to completely enclose all bare current carrying parts."

The Standing Committee on Industrial Applications, which forms part of the Electrical Committee, believed that this recommendation covers the entire matter referred to its subcommittee, but that the recommendation covers only part of the conditions existing. "We can see no reason why knife switches used in connection with motors must be of the enclosed type," the committee reported, "while other knife switches, fuse and cutout terminals, contact plates of rheostat terminals of d-c. motors, etc., are still permitted to be left open by the Code. This committee does not endorse the technical subcommittee's report at the present time and recommends that this whole matter of bare exposed live parts be referred to a technical subcommittee.

Proposed Changes in the National Electrical Code—II

Principal Recommendations for Revisions Made in Reports by Standing Committees of the Electrical Committee, N. F. P. A.

COMMITTEE ON GENERATING AND SUBSTATIONS.

The committee recommended revision of Rule 1*d* by the addition of a paragraph to read:

In a-c systems where generator and transformer are intended to operate as a unit for stepup or stepdown purposes with both pieces of apparatus located in the same building, no protective device will be required between the generator and the transformer.

COMMITTEE ON GROUNDING.

The Committee on Grounding recommended change in and addition to Rule 1*c*, paragraph 1, on generators, to read:

Must, when operating at a potential in excess of 750 volts, have their frames grounded as provided in No. 15A, **except where this is impracticable or operating conditions require their insulation from ground. In these cases special permission in writing must be obtained; the frame must be permanently and effectively insulated from ground and either so isolated from all grounded surfaces or so covered or caged or surrounded by insulating barriers or so provided with insulating mats that no person is liable to touch both frame and grounded surface at the same time.**

In the same rule the first two sentences of paragraph 2 are to be changed and the third sentence changed and made into a new paragraph as follows:

Must, when operating at a potential of 750 volts or less, have their frames grounded as provided in No. 15A, when this is practicable. When this is impracticable **or operating conditions require their insulation from ground,** special permission in writing may be given for omitting the ground connection, in which case the frame must be permanently and effectively insulated **from ground.**

Wooden base frames used **to insulate frames from ground** and wooden floors which are depended upon for such insulation where for any reason it is necessary to omit the base frames must be kept filled to prevent absorption of moisture and must be kept clean and dry.

Change Rule 7 on ground detectors to read:

Each distribution system originating in a station under attendance must be provided with a reliable ground detector, unless permanently grounded as provided in No. 15A.

Motors.—Rule 3, Section *a*. Insert new first paragraph as follows:

Where located in rooms accessible only to competent operators and complying with the conditions required for rooms containing generators in Rules 1a and 1b, must be installed as required for generators in No. 1c, unless installed as required in the next two paragraphs.

Change Rule 8, Section *a*, first and second paragraphs, to read as follows:

Must, when operating at a potential in excess of 750 volts, have no exposed live metal parts, and have their frames grounded, as provided in No. 15A.

When operating at a potential of 750 volts or less, must have their frames grounded as provided in No. 15A, **except when this is impracticable or operating conditions require their insulation from ground. In these cases** special permission in writing **must be obtained; the motor must be permanently and effectively insulated from ground and either so isolated from all grounded surfaces, or so covered or caged or surrounded by insulating barriers or so provided with insulating mats, that no person is liable to touch both frame and grounded surface at the same time.**

Rule 8, Section *b*. Insert new first paragraph as follows:

Where located in rooms accessible only to competent operators and complying with the conditions noted in Nos. 1a and 1b, wiring must be installed as required in No. 2, unless installed as required in the next three paragraphs.

Rule 8, Section *b*. Change present first four paragraphs to read as follows:

Where not located and installed as noted in preceding paragraph:

1. **If operating at a potential of 750 volts** or less must be wired with the same precautions as required by rules in Class "C" for wires carrying a current of the same volume.

2. Motors operating at a potential between 750 and 3500 volts must be wired with approved multiple-conductor, metal-sheathed cable in approved metal conduit.

Next two sentences as at present. Third paragraph as at present but omit present fourth paragraph as unnecessary when new first paragraph is added as recommended above.

Wires.—Rule 12*f*, third paragraph. Change to read:

Metal conduits containing service conductors must be grounded as provided in No. 15A, except as omission of grounds is permitted for short runs of conduit by No. 15A, Section n, third paragraph.

In Rule 12*f*, omit paragraphs numbered 1 and 2, since they are covered by the new wording of Rule 15A, Section *n*.

Grounding Low-Potential Circuits.—Change Rule 15*a*, first paragraph, by omitting words "through overhead construction" and change 550 to 750 volts.

Change Rule 15*a*, second paragraph, to read:

Two-wire d-c. systems **must not be grounded (unless exposed to leakage or induction from overhead circuits above 750 volts in which case they** may be grounded and if grounded must be grounded as provided in No. 15A).

Change 15*b* to read as follows:

All secondary distribution systems (except circuits entirely unexposed through overhead construction **or through transformers or other devices** to leakage or induction from circuits above **750** volts) must be grounded, provided the maximum difference of potential between the grounded point and any other point in the circuit does not exceed 150 volts, and may be grounded when the potential exceeds 150 volts **and, if grounded, must be grounded as provided in No. 15A.**

Method of Grounding.—Rule 15A, Section *a*, first paragraph. Change to read:

Where low-potential circuits are **required to be** grounded **the ground connections** must be so arranged that under normal conditions of service there

will be no appreciable passage of current over the ground conductor.

Rule 15A, Section *d*, first paragraph. Change to require ground connection at *each* service.

Change Rule 15A, Section *d*, second paragraph, to read:

. . . . . **as will not leave any section of secondary without ground protection** after any fuses in the transformer circuits or mains have been blown.

Change Rule 15A, Section *i*, third paragraph, first sentence, to read:

When the service conduit is grounded, its ground conductor must be run direct from it **and no portion of interior conduit is to be used as a part of the ground conductor.**

Rule 15A, Section *j*, second paragraph, first sentence; change to read (second and third sentences remaining as at present):

The insulation and installation of the ground conductor for circuits must comply with all the requirements of the Code for wires of the voltage of the circuit to which the ground conductor is attached and the **ground conductor** must have, after January 1, 1921, **a continuous identifying marking readily distinguishing it from all other wires.**

Rule 15A, Section *j*; add a third paragraph as follows:

The ground conductor for equipment or wire runways must not be interconnected with a circuit ground conductor or a grounded-circuit conductor, except that it may be interconnected with a circuit ground conductor on a circuit grounded at three or more services to an underground water piping system.

Rule 15A, Section *k*, second paragraph; reword as follows:

The ground conductor for a direct-current system must have a current capacity of **less than one-fifth that of the grounded conductor at the point where the ground conductor is attached and must not be smaller than a No. 6 copper wire.**

Rule 15A, Section *k*, third paragraph; substitute the following two paragraphs:

Each of the first three ground conductors on an a-c. system must be not smaller than No. 6 copper wire, nor smaller than one-fifth the current capacity of the wire to which it is attached, except that it need not be larger than a No. 0 copper wire.

Each ground conductor on an a-c. secondary system after the first three must be not smaller than a No. 10 copper wire nor less than one-fifth the current capacity of the grounded conductor at the point of attachment, except that it need not be larger than a No. 0 copper wire.

Rule 15A, Section *m*, second paragraph. Change 15 to **10** amperes and No. 14 to No. 18 for ground wire.

Rule 15A, Section *m*; omit present third paragraph, since new third paragraph of Rule 15A, Section *j* above covers this matter.

Rule 15A, Section *n*, third paragraph; change to read as follows:

Where runs of armored cable, conduit or metal raceway not over 15 ft. long or service runs of any length are used for the protection of wires and are installed in other respects in accordance with Rule 27 for armored cable conductor, 28 for conduit, or 29 for raceways, these runs need not be grounded if the short runs of armored cable, conduit or raceway are insulated from ground and from metal conduit, armored cables, metal raceways and metal work on the premises and are either isolated or guarded when within reach of grounded surfaces.

Rule 15A, Section *n*, fourth paragraph; omit first sentence, since already covered by Rule 15A, Section *j*, first paragraph.

Rule 15A, Section *n*; omit fifth paragraph since covered more adequately by proposed Rule 15A, Section *j*, third paragraph, as above.

Rule 15A, Section *p*; change to read:

Protective ground connections must not be made to **grounded conductors or rails of electric railway** circuits when other effective means of grounding are available, **except ground connections for lightning arresters, equipment or wire runways on such electric railway circuits.**

Rule 15A, Section *q*, first paragraph; change to read:

Ground connections to underground metallic piping system must be made on the street side of water meters **and shutoff cocks,** but connections may be made . . . . etc.

Change Rule 15A, Section *q*, second paragraph, to:

Ground connections for equipment, **conduit,** wire **raceways, armored cables, and for multiple grounds of an a-c. secondary system after the first three underground water pipe grounds** may be made to the water piping system near the part to be protected. In such cases care should be taken to electrically connect all parts of the piping system liable to **be physically disconnected** and to shunt the pipe system where necessary around meters **and shutoff cocks** in order to keep the connection with the underground piping system continuous.

Rule 15A, Section *r*, first paragraph; change to read:

The ground connection to metallic piping systems must be made **either:**

1. By use of a ground clamp of copper not less than 1/16 in. in thickness bolted to the pipe after it has been freed from all rust and scale. No iron or steel to be used in the clamp except for the clamping bolt and the lug for ground conductor to be an integral part of the clamp.

2. By screwing tightly into the pipe or a pipe fitting a brass plug having a lug for ground conductor, or by other equivalent means.

Rule 25, Section *e*, second paragraph, first sentence, change to:

The metal frame of such stationary heaters should preferably be grounded **and if operating on circuits above 150 volts to ground must be grounded,** and if grounded must be **grounded** as provided in No. 15A.

On page 60, change the subhead under Low-Potential Systems to read, "**750** Volts or Less"; in the fifth line of the preamble change 550 to 750, and omit last sentence of preamble.

Change Rule 26, Section *a*, first paragraph, first sentence, to read:

(After January 1, **1921**) The neutral conductor on all 3-wire circuits and one conductor on all 2-wire circuits must have **a continuous** identifying **marking** readily distinguishing it from other wires.

Change Rule 26, Section *e*, third paragraph, to read:

When metal pipe is used **in short runs to protect wires,** the insulation of each wire must be reinforced by approved flexible tubing extending from the insulator next **beyond** the pipe **at one end** to the insulator next **beyond the pipe at the other end.** The two or more wires of a circuit, each with its flexible tubing, if carrying alternating currents must, or if direct current may, be placed within the same pipe.

Rule 27, Section *c*; change to read:

Must have the metal armor of cables grounded as required in No. 15A **with the exceptions for short runs of cable in Section (n) of that rule.**

Rules 28, Section *f*, and 29, Section *e*; change similarly to above for 27*c*.

Rule 30, Section *a*; for first paragraph substitute the following and omit fourth paragraph and its four numbered subparagraphs altogether.

Must be grounded as provided for equipment in No. 15A, except where the fixture is insulated from ground and from metal conduit, armored cables,

raceways and metal work on the premises, and is also isolated or guarded when within reach of grounded surfaces.

Rule 30, Section *d*; change to read:

Where shells or outlet boxes are used they must be made sufficiently large to allow of adequate insulation of splices in conductors.

Rule 30, Section *f*; change to read:

Wires of different systems must never be contained in or attached to the same fixture, and under no circumstances must any conductors contained in or attached to a fixture operate at a potential of over 300 volts to ground or between wires.

Rule 32, Section *b*; change to read:

Must not, except in street railway property, be used where the voltage between any conductors or from any conductor to the ground is over 300 volts.

Rule 37A, Section *a*, second paragraph; add at the end, "as provided in No. 15A."

Rule 39, Section *i*; add at the end, "and the troughs must be grounded as provided for conduit in No. 15A."

On page 122, change the subhead under High-Potential Systems to read, "750 to 3500 Volts"; in the fourth line of the preamble change 550 to 750 volts, and omit last sentence of preamble.

Rule 45, Section *c*; insert after the words "effectively grounded" the following: "as provided in No. 15A."

The committee also suggested that, for the sake of uniformity, the various rules covering the limits between low-potential and high-potential circuits be amended to make this limit 750 volts in all cases instead of 550, 600 and 700 as at present in different portions of the Code.

COMMITTEE ON INDUSTRIAL APPLICATIONS.

The committee recommended quite extensive changes in the rules covering protection of motors and motor switches. In Rule 8*b*, strike out the fifth and sixth paragraphs and also all of Rule 8*c*, substituting therefor the following:

c. **Overload Protection of Motors.**

Each motor must be protected by an automatic cutout (fuses or circuit-breaker). If fuses are used, one fuse must be provided in each conductor. If a circuit-breaker is used, one pole must be provided in each conductor. It must be so designed that its operation will open all of the conductors simultaneously, and the number of overload trip coils must not be less than shown in the following table, except that for d-c. and single-phase a-c. motors, one single-pole circuit-breaker may be used in each conductor or a single-pole circuit-breaker in one conductor and a fuse in the other.

System.	No. of Overload Trip Coils.
4 wire, 2 phase a-c.	2—(1 in each phase)
3 wire, 2 phase a-c.	2—(1 in each outside conductor)
3 wire, 3 phase a-c.	2—(1 in each of 2 phases)
2 wire, a-c. or d-c. ungrounded	1—
2 wire, a-c. or d-c. grounded	1—(in the ungrounded conductor)

Except on main switchboard or when otherwise subject to competent supervision, an approved fuse must be provided in each conductor of motor circuits whether an automatic overload circuit-breaker is installed or not. Circuit-breakers will be approved for circuits having a maximum capacity greater than that for which approved enclosed fuses are rated.

If an a-c. starter when in the running position opens all of the conductors of the circuit automatically under overload, and is equipped with the proper number of overload trip coils as given above, it may also serve as a circuit-breaker. If the overload release device of a d-c. starter is inoperative during the process of starting the motor, a separate circuit-breaker or set of fuses must be provided.

(1) Protection for continuous-rated motors used for so-called continuous duty, which are connected to branch circuits protected by fuses of over 10 amperes or circuit-breakers set at over 10 amperes, must consist of a set of "running" fuses or circuit-breaker in accordance with the following:

If fuses are used the capacity of the fuses must not exceed 110% of the nameplate current rating of the motor, except that when no fuse of the required capacity exists fuses of the next higher standard rating may be used. If a circuit-breaker is used, it should have a continuous current-carrying capacity of at least 110% of the nameplate current rating of the motor. If the circuit-breaker is of the time-limit type, it should have a setting of not over 110%, and if of the instantaneous type, a setting of not over 140% of the nameplate current rating of the motor. A circuit-breaker of the instantaneous type should not be used to protect an a-c. motor of the type requiring large starting current unless special permission in writing is obtained.

To comply with the above rule, in the case of motors having large starting currents, it will be necessary to use a motor starter or double-throw switch so designed that the protective device will be shunted or cut out of service during the starting period, unless a time-limit circuit-breaker or similar device is used which will prevent the opening of the circuit during the starting period.

(2) Continuous-rated motors which are connected to branch circuits protected by fuses of 10 amperes or less or circuit-breakers set at 10 amperes or less are considered as being properly protected by these circuit-protective devices. Small motors may be grouped under the protection of a single set of fuses, provided the rated capacity of the fuses does not exceed 10 amperes and the total wattage of the circuit does not exceed 660.

(3) Motors of short time rating, used for duty-cycle work, must be protected by fuses rated at not over the percentages of the motor nameplate current ratings given in the following table, by time-limit circuit-breakers set at not over these percentages, or by instantaneous type circuit-breakers set at not over 30% above these values.

[Here is inserted the same table that now appears at the end of Rule 8*b*.]

Size and Protection of Conductors of Motor Circuits.

Conductors carrying the current of only one motor must have a carrying capacity of at least 110% of the nameplate current rating of the motor.

Each conductor carrying the current of only one motor and each ungrounded conductor carrying the current of a group of motors must be protected in accordance with the general requirements for the protection of conductors; that is, the rated capacity of the fuses must not exceed the carrying capacity of the conductors and circuit-breakers must not be set more than 30% above the carrying capacity of the conductors, as given in No. 18. Where rubber-covered wire is used in a branch circuit carrying the current of only one a-c. motor of a type having large starting current and this circuit is protected by fuses or an instantaneous-type circuit-breaker, it may be protected in accordance with Table B of No. 18, but in no case should a rubber-covered conductor in a branch circuit carrying the current of only one motor have a carrying capacity in accordance with Table A less than 110% of the nameplate current rating of the motor.

To provide for the large starting currents of certain types of a-c. motors without overfusing the conductors, wires considerably larger than 110% of the motor nameplate current rating may be necessary in that part of the circuit not included in the protection afforded by the motor protective device.

In the great majority of cases where a-c. motors requiring large starting currents are started by means of autostarters, the necessary current-carrying capacity of conductors in that portion of the motor circuit not included in the protection afforded by the motor protective devices will not exceed the following percentages of the nameplate current rating on the motors.

Rated full-load current.	Percentage.
0 to 30 amperes	250
Above 30 amperes	200

In nearly all cases where a-c. motors of the above type are started without autostarters, the necessary current-carrying capacity of conductors in that portion of the motor circuit not included in the protection afforded by the motor protective devices will not exceed 300% of the nameplate current ratings of the motors.

To provide for the peak loads which are encountered in

certain classes of service, such as operating valves, raising or lowering rolls, rolling tables, hoists, elevators, pumps, etc., without overfusing the conductors, motors will sometimes require cables considerably larger than 110% of the motor nameplate current rating. In the majority of cases the current-carrying capacity of conductors complying with the rule will not exceed the percentages of the nameplate current ratings of the motors given in the table under Section c (3) above.

Motor Switches.

Each motor with its starting device **(except as provided for electric cranes, see No. 43c)** must be **controlled by a switch so designed as to indicate whether it is open or closed and so arranged that the opening of the switch will disconnect all of the wires, that is, in a two-wire system the two wires and in a three-wire system the three wires must be disconnected by the operation of the switch. Where a double-throw switch is used to shunt the motor protective device during the starting period it must be of such type that it will be held in off and running positions but cannot be left in the starting position without the proper running overload protective devices in the circuit. With two-wire** motors of ¼ hp. or less on circuits where the voltage does not exceed 300, single-pole switches may be used. **An automatic circuit-breaker which disconnects all wires of the circuit may also serve as a swtich.** The switch and **starting device** must be located within sight of the motor, except in cases where special permission to locate them elsewhere is given in writing.

Except for autostarters the switch called for in the preceding paragraph may be omitted where the motor starter disconnects all wires of the circuit. When autostarters are used a switch must be provided on the supply side of each autostarter or group of autostarters.

Change the second paragraph of Rule 19*a* to read:

Except as provided for generators in No. 1d an automatic overload circuit-breaker **when installed without other automatic overload protective devices, must have one pole in each ungrounded conductor, except that for branch or tap circuits which are directly connected to lamp sockets or other translating devices a pole must be provided in each conductor and it must be so designed that its operation will open all of the conductors simultaneously. This rule will not be considered as prohibiting the use of two single-pole circuit-breakers for the protection of two-wire circuits. The number of overload trip coils must not be less than shown in the following table:**

System.	No. of Overload Trip Coils.
4 wire, 3 phase A.C.	3—(1 in each phase)
4 wire, 2 phase A.C.	2—(1 in each phase)
3 wire, 2 phase A.C.	2—(1 in each outside conductor)
3 wire, 3 phase A.C.	2—(1 in each of 2 phases)
3 wire, 1 phase A.C.	2—(1 in each outside conductor)
3 wire, D.C.	2—(1 in each outside conductor)
2 wire, A.C. or D.C. ungrounded	1—
2 wire, A.C. or D.C. grounded	1—(in the ungrounded conductor)

If a circuit-breaker is also used in place of the switch it must be so arranged that no one pole can be opened manually without opening all poles.

Amend first paragraph and fine-print note of Rule 23*e* to read:

Except as provided for motors under No. 8c, the rated capacity of fuses must not exceed the allowable carrying capacity of the wire as given in No. 18 and circuit-breakers must not be set more than 30% above the allowable carrying capacity of the wire unless a fusible cutout is also installed on the circuit.

Strike out Rule 23*f*.

Rule 8*b*, second paragraph; change to read:

Motors **must not operate** at a potential **exceeding 2500 volts,** except in central stations, substations and **generator and motor rooms. Motors operating at a voltage above 550 volts** must be wired with approved multiple-conductor, metal-sheathed cable in approved metal conduit **except in central stations, substations, generator and motor rooms and except that where not exposed to moisture, the sheathing may be omitted by special permission. Where not exposed to moisture, the metal sheath need not be provided over splices, but where the sheathing is required on the rest of the cable, the ends of the sheaths must be belled out and bonded around splices by No. 6 B. & S. gage copper wire and approved ground clamps. Except in central stations, substations and generator and motor rooms,** all apparatus and wiring connected to the high-**voltage circuits** must be completely enclosed in substantial metal shields or casings and the conduit must enter and be properly secured to such casings or to suitable terminal boxes screwed or bolted to the casings. Shields, casing and conduit must be grounded as provided in No. 15A.

Rule 8*b*, third paragraph; omit last sentence.

Rule 8*b*, fourth paragraph; change "3500" in second line to **"2500."**

Page 122, change subhead under High-Potential Systems, to read "550 to **5000** volts."

Page 122, change "3500" to "**5000**" in the fourth line of the preamble in italics.

Rule 44*a*, first paragraph; change to read:

Conductors muse be approved multiple-conductor metal-sheathed cable in approved metal conduit installed as required by Rule 28, **except in central stations, substations and generator, motor and transformer rooms and except that by special permission the sheathing may be omitted where not exposed to moisture. (For motors, see No. 8b.) Where not exposed to moisture the metal sheath need not be provided over splices, but where the sheathing is required over the rest of the cable the ends of the sheaths must be belled out and bonded around splices by No. 6 B. & S. gage copper wire and approved ground clamps.**

Except in central stations, substations and generator, transformer and motor rooms, all apparatus and wiring connected to the high-voltage circuits must be completely enclosed by substantial metal shields or casings, grounded as required in No. 15A, and the conduit must enter and be properly secured to such casings or to suitable terminal boxes screwed or bolted to the casing.

Rule 44*b*, omit second paragraph. Change Rule 44*c* to:

In central stations, substations, generator and transformer rooms, **and in motor rooms adjoining an outside wall where the conductors entering from the outside are not in conduit,** conductors may be rigidly supported on glass or porcelain insulators, etc.

Rule 19*b*; add third sentence to first paragraph to read **"See No. 35A for equipments in extra hazardous places."**

Insert a new rule following No. 35 to read as follows:

35A. Equipments in Extra Hazardous Locations.

a. All electrical devices and apparatus which tend to create sparks or arcs or which may ignite highly inflammable gases, liquids, mixtures or other substances must not be used in rooms, or compartments, where such materials are manufactured, used, or stored in other than original containers unless of the totally enclosed type approved for the purpose.

b. All wiring shall be armored cable or installed in approved metal conduit. All lamps must be enclosed in vaporproof globes and guarded. Switches and motors, except motors direct-connected to ventilating fans at the point of discharge from the building, must not be located under any hood or in any vent pipe. All swtiches and motors must be of a type specially approved for the purpose.

The committee, which considered the matter of wires between contact plates and resistors of rheostats, recommended that the first sentence of No. 4*c* be amended to read:

Whenever insulated wire is used for connections between resistance elements and the contact device of a rheostat, **except for motor-starting service,** the insulation must be noncombustible or slowburning.

(To be concluded.)

New Appliances

New Electric Furnace Is of Simple Construction—Ingenious Method of Fastening Conduits to Pole—Butt-Treating Plant

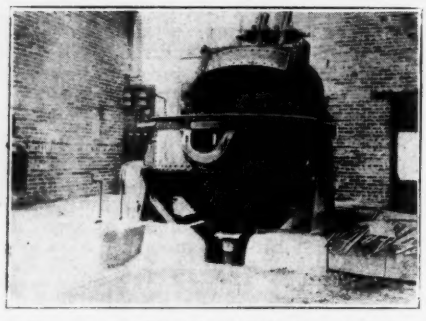
New Electric Furnace Is of Simple Construction.

Simplicity both in construction and operation is the keynote of the new type electric furnace put on the market by the Industrial Electric Furnace Co., 53 West Jackson boulevard, Chicago. The furnace is built as the result of wide experience in the design and operation of electric furnaces for the melting and refining of iron and steel.

Electrical connections have been arranged so that a substantially balanced load is maintained on either a two or three-phase system. Power is put into the furnace in two arcs of approximately 1800 amperes each at 120 volts. Switching arrangements are provided for changing the voltage. The standard switchboard includes operating handles, ammeters, voltmeter and watt-hour meters. A power-factor of 80% is preferred but the substations can be designed for higher or lower power-factor as desired. External secondary reactors are used to protect electrical equipment and prevent undue surges on lower lines.

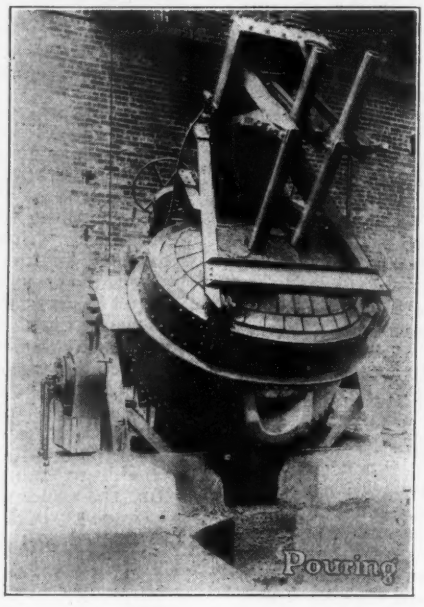
Electrical regulation is accomplished by raising and lowering the electrodes in the two-arc furnace. This is usually done with motors, which, in turn, may be controlled by General Electric or Westinghouse automatic regulators, as specified. The use of the secondary reactance makes regulation partially inherent.

Copper cranes are used for supporting electrodes and conducting current from back of furnace. These cranes can be controlled by hand motor with remote switch control or automatic control. The opening roof system is used. With this arrangement charges can be dropped from a charging bucket directly into the furnace, no doors being used. The motor for opening and closing the roof is at the back of the furnace and is controlled by a drum-type controller mounted for convenient operation.



Furnace in Position to Receive Load.

The furnaces are built in oval shape to allow sufficient distance not only between electrodes, but also between electrodes and furnace wall. The hearth is consequently large and shallow so that maintenance of either basic or acid lining is simple. The shallowest possible slag depth is required for refining. Where basic lining is used the metallic contact to hearth is not required.



Furnace in Position to Discharge Load.

The advantages of the electric furnace can be retained and, at the same time, a substantial economy in heating can be effected by use of the preheating process in connection with this new furnace, known as Industrial electric furnace No. 501. With this method the charge is heated to a cherry-red by some outside means before the electric heating is used. At the cherry-red temperature steel will not be effected by any fuel used—oil, gas, coal or coke. As an example of this economy fifteen gallons of oil used for preheating will save 200 kw. hours of electrical energy per ton of metal melted. The preheating method will increase the capacity of the electric furnace 50%.

All these advantages are possible, however, only when the opening-roof, doorless-type electric furnace is used. With this method, the preheated charge can be taken out of the preheating furnace and dropped directly into the open-electric furnace.

New Method of Fastening Conduits to Poles.

An ingenious method of fastening conduits, etc., to tubular steel and concrete poles of any section and size has been perfected by the Bush Electric Co., 6654 Broadway, Cleveland, O.

In operation the device is quite simple. A band is passed around the pole and through the seating clip in such a manner as to hold conduit firmly against the pole when the band is tightened. One end of the band is bent around a cross-bar in the fastening buckle so that it cannot be undone when the band is under tension. The band is tightened by means of a cinching tool which may be set at any point on the loose end to give any tension desired. The leverage thus obtained causes the band to conform to the shape of the pole. When the cinching tool has been brought around against the pole, the loose end of the band is fastened by bending over the fastening lugs, two blows of a hammer being required.

The design and application of this device is shown in the accompanying illustrations. Fig. 1 is a sectional view of a pole showing the method of seating conduit. Fig. 2 shows the cinching tool placed on the band with about one-half of the ultimate tension applied, the arrow indicating the direction of motion. The buckle after the band has been tightened and clamped is shown in Fig. 3.

Fig. 1—Sectional View, Showing Method of Attaching Conduit to Pole.

Fig. 2—Cinching Tool on Band with One-half Tension Applied.

The manufacturers claim that the advantages of this method over those in use at present are numerous. Tubular steel poles are built in sections, the diameter decreasing toward the top, and concrete poles are tapered from the

ground up. With forged bands fastened with bolts and nuts such as are ordinarily used, it is necessary to have exactly the right size band to fit the pole at the desired point, a condition that necessitates the carrying of a large stock of forged bands in various sizes. With the method described, however, the same equipment may be used on all sizes and shapes of poles, the band being carried in rolls and cut off to any desired length. All bolts are eliminated. The bands are quickly attached and remain securely in place until

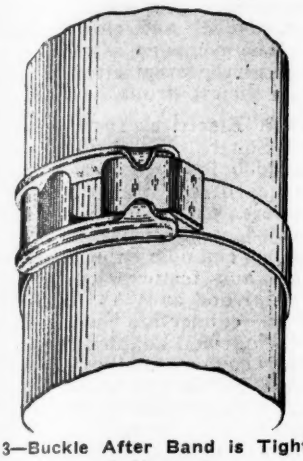


Fig. 3—Buckle After Band is Tightened and Clamped.

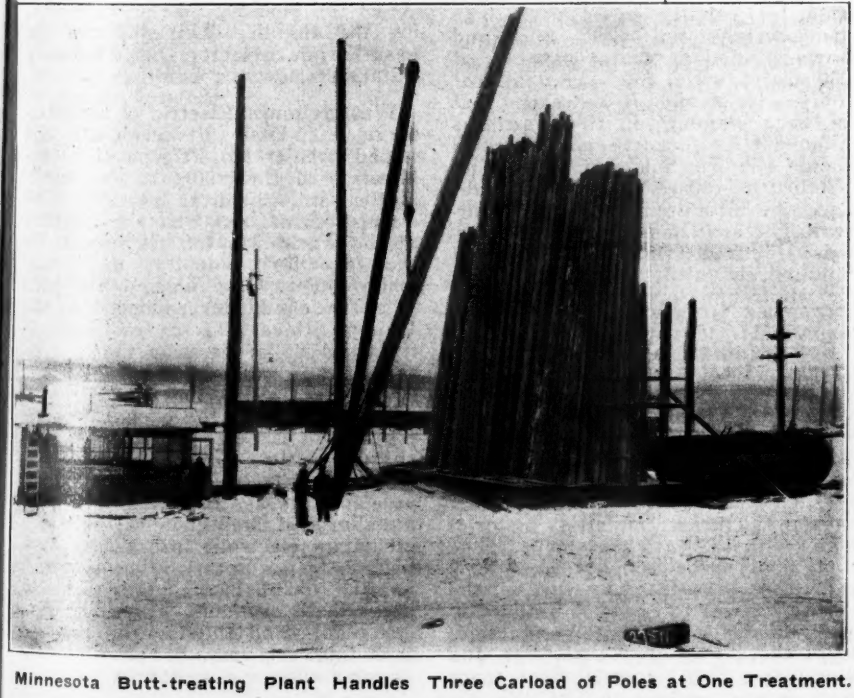
the fastening lugs are cut with a cold chisel. All parts are thoroughly weather-proofed to prevent rust.

The device is also adapted for attaching car-stop signs to poles.

New Butt-Treating Plant Has Three-Carload Capacity.

Realizing some years ago that the supply of cedar poles for carrying electric wires was in need of conservation the Valentine-Clark Co., Minneapolis, Minn., built a plant in 1907 for the butt-treatment of poles, the first of its kind to be erected in the northwest. This was a small plant with a capacity of one carload of poles a day.

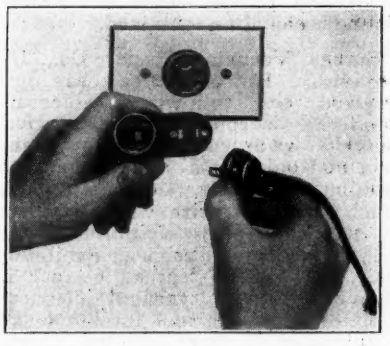
The need of conservation becoming more acute the company in 1913 added another butt-treatment unit with a capacity of three carloads a day, but even this did not keep up with the demand and last summer the company started a third plant, shown in picture herewith, and which has a capacity of three carloads of poles at one time. The plant has two tanks measuring 10 by 18 ft, and 11 ft. in depth, while the third tank is 14 by 14 ft. and 15 ft. deep. In the picture is shown 206 western red cedar poles of 8 in. diameter and ranging from 50 to 65 ft. in length being treated at one time.



Minnesota Butt-treating Plant Handles Three Carload of Poles at One Treatment.

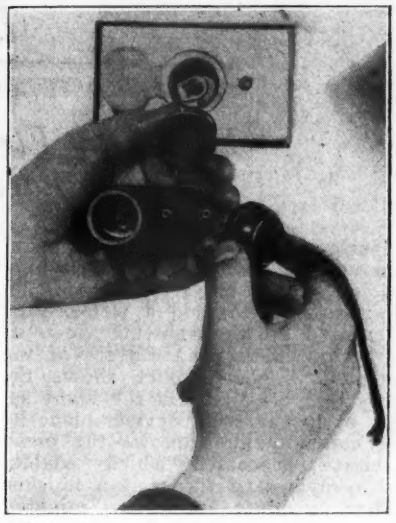
New Tap Device for Obtaining Double Service.

Every home, office, factory, store or business establishment frequently wishes to obtain double current service from a single socket or receptacle and almost as frequently it is found



"Jiffy" Tap for Wall Receptacle.

there is no tap available. Paul W. Koch & Co., 19 South Wells street, Chicago, originators of the "Jiffy" line of electrical appliances, recognizing the need of such a tap, have placed on the market the "Jiffy" current tap, an appliance that makes a duplex out of a single receptacle. The device has a rating of 660 watts so that practically any two-socket appliance may be operated from it in perfect safety. The tap



"Jiffy" Tap for Standard Socket.

is inexpensive, is built to give lasting service and is easily attached or detached.

Landers, Frary and Clark Add Cleaner to "Universal" Line.

One of the large group of "Universal" home needs in electrical devices re-

Cleaner Added to "Universal Line.

cently put on the market by Landers, Frary & Clark, New Britain, Conn., is the "Universal" vacuum cleaner. The cleaner is put on the market by the firm after the most exhaustive factory tests. In connection with the vacuum cleaning volume of air there is a gear-driven brush that picks up pieces of thread and lint attached to the carpet without injuring the delicate fabric.

Trade Activities

Delta-Star Electric Co. Shows Benefit of Central-Station Service to Farmers—Eureka Vacuum Cleaner Wins Prize

Hurley Machine Co., Chicago, manufacturer of "Thor" electric washing machines and other household devices, has just issued a well-printed illustrated booklet showing views of its plant, offices, and officers of the company. The booklet shows the steps that are taken in the manufacture of the different devices made by the company and follows the many intricate processes which enables the company to turn out a finished "Thor" product every two minutes. From a humble beginning in a small room on South Jefferson street, Chicago, a little more than 12 years ago the Hurley business has grown and the organization developed until today the plant is the largest, as well as the oldest, manufacturers of electric washing machines in the world.

S. E. Hendricks Co., Inc., New York City, has just published the 28th annual edition of "Hendricks' Commercial Register of the United States for Buyers and Sellers," after being delayed two months by the printers' strike in New York. Several improvements are contained in the new edition, the most noticeable being the new method of exterior indexing by coloring the front edge red, white and blue to indicate the different main sections of the book. The main classified trades list contains 1813 pages, listing over 18,000 different products. Other sections of the book include the "Trades Index," in which every product listed is indexed and cross-indexed, a section devoted to trade names and a complete alphabetical list of all manufacturers and products named in the book. The whole book makes a volume of 2703 pages.

Delta-Star Electric Co., 2433 Fulton street, Chicago, manufacturer of unit-type farm power and lighting equipment, has issued a large folder showing in detail form the benefits farmers can derive from having central-station service brought to their farms. The folder in brief form tells of the various devices that will aid the farmer in his work, the descriptions being accompanied by illustrations. In connection with the folder the company is sending out a two-form blank designed to increase central-station business by getting farmers interested in securing electric power for the many farm uses. One of the forms is for the farmer to fill out and send to the nearest power company asking the company to make the farmer a proposition on furnishing electric light and power service. The other form goes to the Delta-Star company to enable it to get in touch with the power company interested.

Ilg Electric Ventilating Co., Chicago, has taken advantage of the motion-picture industry as a means of advertising and showing the good effects of proper ventilation in factories and offices. The Ilg company through the Rothacher Film Manufacturing Co., Chicago, has made and is sending broadcast throughout the country, the educational-industrial picture "Health and Welfare Work." The films were made at the Ilg plant, in the Rothacher Chicago studio and at outside points where the proper settings could be obtained.

Eureka Vacuum Cleaner Co., 101 Broadway, Detroit, Mich., has just received the following cablegram from its European representative: "Eureka awarded both the Grand Prix and gold medal at Hygienic Exhibition, Brussels, Belgium." This much coveted prize which is given by the Belgium Exhibition Directorate at the Inter-European exhibition was won by the Eureka cleaner in competition with vacuum cleaners, both of American and foreign make. Established 12 years ago, the Eureka company outgrew its old quarters and last fall erected and occupied a large new factory where even with production tripled the demand has grown until the company is oversold for months to come.

Consolidated Utilities Corp., of Chicago, 730 South Michigan avenue, Chicago, describes its new light style 1-kw. Matthews lighting and power plant as the most compact plant made for country home use. The plant weighs only 395 lbs., and shows a rated generator capacity of 1000 watts with 20% overload capacity. Its engine is the same that has been standard in the Matthews equipment for seven years. A radical change has been made in the cooling system, the old-style tank being replaced by an automobile-type of radiator. The switchboard has been condensed into a small compass and mounted above the generator so that the whole unit boxes into a package only 45 by 34 by 22 ins.

Peerless Light Company, Chicago, formerly located at Halsted, Adams, and Green streets, has moved its office and factory to Washington boulevard, Meridian and Union streets. The old quarters had become inadequate to the needs of their business. The company's new home is a substantial brick building, 6-stories high, with a large basement. The total floor space is about 125,000 sq. ft. It has been fitted up with all the known devices to expedite production and minister to the comfort and safety of executives, office assistants, and workmen. Every foot of floor space will be needed properly to care for their chandelier and electric-lighting trade. The company is now in condition to give prompt attention to the needs of their patrons.

Rawson Electrical Instrument Co., Central Square, Cambridge, Mass., has issued bulletin No. 100 telling the advantages of the Paul unipivot galvanometers, pattern 1, which it has just placed on the market. This galvanometer embodies the same construction and features as the larger Paul unipivots and is particularly useful in connection with vacuum tubes, being well adapted for indicating wing current, and for measuring the amplification and other tube constants. It is supplied with galvanometer scale, zero center, and also in full scale ranges from 24 microamperes to one ampere, and from 1.8 millivolts to 100 volts.

Cutler-Hammer Manufacturing Co., Milwaukee, Wis., is sending to the trade a 48-page booklet, "Making Driving Easy," in which the claims of the C-H magnetic gear shift are told by the company, or rather by some of the 5000 motorists who have been driving cars equipped with the magnetic shift device during the past four years. Excerpts giving opinions and data on operation written by drivers are arranged according to states with several pages devoted to notes from motor car dealers handling the equipment. On the cover of the booklet is illustrated the new finger lever located on the quadrant above the steering wheel, convenient for the thumb. This replaces the push-button selector box formerly installed below the wheel.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has issued circular No. 7176 entitled "Application of Electricity to the Metallurgical and Chemical Industry." The circular points out that the stimulus of the world war left its imprint on the chemical industry, and that while before the war period the value of chemical products in the United States was a few hundred thousand dollars a year the production is now at the rate of $16,000,000 yearly. According to the Westinghouse circular the chemical industry is the largest user of electric energy in the United States. The circular treats on all subjects wherein electricity is connected with the metallurgical and chemical industry, including electrolic processes, dyes, phosphates, potash, atmospheric fixation of nitrogen, sulphuric acid, soda-alkali products, chlorine, powder plants and the Cottrell process, including recovery of potash. The circular will be issued broadcast.

Current News

News of Construction Activities and Business Opportunities

EASTERN STATES.

Boston, Mass.—A. DeStefano, 10 Everett street, East Boston, has taken bids for the construction of a new 2-story brick and steel refrigerating plant, about 30 by 40 ft. Considerable refrigerating equipment will be required, it is understood.

Holyoke, Mass.—Holyoke Water Power Co. has completed arrangements for the disposal of its property on South street, aggregating about 260,000 sq. ft. to new local interests.

New Britain, Conn.—Landers, Frary & Clark have completed negotiations for the purchase of a tract of land at Meriden, Conn., to be used as a site for the construction of a number of residences for its employes' service.

New Haven, Conn.—Truscon Steel Co., of Youngstown, O., contemplates the erection of a steel storage warehouse at New Haven.

Windsor, Conn.—Central Electric Co., 920 Western avenue, Lynn, Mass., has awarded a contract for the construction of a new local plant. William M. Bailey Co., 88 Broad street, Boston, Mass., is the contractor.

Brooklyn, N. Y.—In connection with the construction of the proposed new 3-story ice plant and cold storage building, about 130 by 135 ft., to be erected by the Brooklyn Retail Butchers Corp., 3285 Fulton street, at Atlantic avenue and Fort Greene place, considerable electrical and refrigerating equipment will be required. The proposed new plant is estimated to cost about $400,000, including machinery installation. A. Rosen is president.

Brooklyn, N. Y.—New York Telephone Company, 15 Dey street, New York, has had plans prepared for alterations and improvements in its 6-story administration building located on Clinton street, near Atlantic avenue. The work is estimated to cost about $22,000. E. A. Munger, 203 Broadway, New York, is architect.

Dunkirk, N. Y.—Continental Heater Corporation has filed notice with the Secretary of State of an increase in its capitalization from $150,000 to $250,000, to provide for general business expansion.

Long Island City, N. Y.—Astoria Light, Heat & Power Co., Shore road, has awarded a contract to the George A. Fuller Company, 175 Fifth avenue, New York, for the construction of a new 2-story brick shop building, about 60 by 362 ft. The structure is estimated to cost about $150,000, including equipment installation.

New York, N. Y.—Electrical and mechanical equipment will be required in connection with the construction of the proposed new laundry plant of the Sanitary Laundry Co., 811 East Ninth street, to be located at 227-29 Mulberry street. The structure will be 1-story, brick, about 100 by 100 ft., and is estimated to cost $20,000.

New York, N. Y.—New York Telephone Co., 15 Dey street, is making rapid progress on the construction of the new addition to its Bowling Green telephone exchange plant at 104 Broad street, and all miscellaneous contracts to insure the early completion of the structure have been awarded.

New York, N. Y.—New York Edison Co., Irving place and 15th street, has been awarded a contract for furnishing service to the Stock Exchange building, to replace the private plant heretofore in operation.

New York, N. Y.—Bailey Electrical Supply Co. has completed negotiations for the leasing of the entire 6-story building at 268-70 Canal street, for a term of years at an aggregate rental of about $250,000.

New York, N. Y.—Vesta Storage Battery Co., 1696 Broadway, is arranging for the establishment of a repair service works at 47-49 West 63d street.

New York, N. Y.—Schuck & Co. have completed arrangements for the leasing of property held by the Interborough Rapid Transit company at Westchester and Brook avenues, for a long term of years, and plans are being made for the remodeling of the structure into a 1-story refrigerating plant for cold storage purposes.

Rochester, N. Y.—Ontario Cold Storage Co., E. & B. building, has arranged for the immediate construction of a new cold storage plant to be located at Ontario, N. Y. The proposed works are estimated to cost about $100,000, and it is understood that considerable electrical and refrigerating apparatus will be required. G. A. Wagner, 12 Amherst street, Rochester, is architect.

Schenectady, N. Y.—President E. W. Rice, Jr., of the General Electric Co., announces an increase of 1% in the interest rate on the company's recent issue of employes' bonds, bringing their return to holders to 7%. So far 9,866 employes in all plants of the company have subscribed to $1,779,550 of the bonds.

Watertown, N. Y.—Plans are under consideration by interests connected with the International Paper Co. and the Hinde & Dauch Paper Co., with plants in the vicinity of Sewalls island, for the construction of a new hydroelectric plant for local service. The project is understood to involve an expenditure of close to $1,000,000.

Elberon, N. J.—Western Electric Co., 195 Broadway, New York City, has completed foundation work in connection with the construction of its proposed new local Foxhurst radio station. All miscellaneous contracts to insure the early completion of the work, have been let.

Irvington, N. J.—Lionel Corp., 605 South 31st street, manufacturer of electric-operated toys, etc., has completed plans for the construction of a new 4-story plant, to be used for increased capacity. The structure will be brick, about 75 by 82 ft., and is estimated to cost about $50,000.

Newark, N. J.—Plans have been completed for the construction of the proposed new woodworking plant of Clark & Co., Rose street. The new works are estimated to cost about $150,000, and will be thoroughly modern throughout. The structure will be about 55 by 70 ft., and the plans include the boiler and engine room. It is proposed to utilize electric-operated wood-working machinery and equipment wherever possible, and electric elevators and automatic sprinkler systems will also be installed. Thomas M. Clark is president.

Newark, N. J.—John M. Campbell & Co., Plum Point lane, manufacturers of dyestuffs, chemicals, etc., have had plans prepared for the construction of a new 1-story brick power plant, about 50 by 100 ft., to be erected in connection with a total of five additional units at the works of the company. The entire building program is estimated to cost about $150,000. Percy B. Taylor, Essex building, Newark, is architect.

Newark, N. J.—Davis Electrical Co. has completed negotiations for the leasing of property at 15 Central avenue, for a new establishment.

Newark, N. J.—Dan White Market Co. is arranging plans for the construction of a new 2-story and basement refrigerating building and packing plant, about 40 by 100 ft. The proposed structure will be of reinforced concrete construction, and considerable refrigerating machinery and cooling apparatus will be required.

Newark, N. J.—Independent Lamp & Wire Co., Inc., 1733 Broadway, New York, has completed plans for the erection of the proposed new plant to be erected on property at Runyon street, Hillside and Belmont avenues, Newark.

Passaic, N. J.—Fire recently destroyed a large planing mill, boiler plant and engine room at the plant

of the Anderson Lumber Co., with total loss estimated at about $175,000.

Phillipsburg, N. J.—Warren Soapstone Co. has awarded a contract to the Eastern Pennsylvania Power Co. of New Jersey for furnishing additional electric energy for the increased operation of its plant.

Phillipsburg, N. J.—General Pulverized Limestone Co. has completed negotiations for the leasing of the power plant of the Eastern Pennsylvania Power Co., located in Columbia, N. J.

Phillipsburg, N. J.—Borough council has recently completed the installation of new electric-lighting units for the street-lighting system, to replace the arc lamps heretofore in operation. Electric energy is furnished by the Eastern Pennsylvania Power Co. of New Jersey.

South Amboy, N. J.—Plans are under consideration by the local authorities for improvements in the electric street-lighting system, to facilitate operations. Electrical energy is furnished by the Monmouth Lighting Co.

Trenton, N. J.—Public Service Railway Co. is having plans prepared for the construction of the proposed new trolley terminal to be located on property formerly occupied by the Trenton Banking Co., South Warren street, near State street.

Wilmington, Del.—Public Service Commission has granted permission to the Diamond State Telephone Co. to continue operating under the wartime telephone rate schedule for a period of one year.

Bath, Pa.—The power plant at the works of the Penn Allen Cement Co., near Bath, was wrecked on Feb. 5 following a severe snow and sleet storm which caused the collapse of the roof of the building, severely damaging machinery and equipment valued at approximately $100,000.

Easton, Pa.—Pennsylvania Utilities Co. has recently completed improvements in its various plants, to provide increased efficiency in operation. The work includes the installation of new generator equipment at the company's plant at Stroudsburg; the remodeling of the 5000 kw. generator at the local plant and re-installation of this unit; as well as improvements providing for the automatic operation of its substation at Delabole.

Harrisburg, Pa.—Harrisburg Light & Power Co. has had plans prepared for the installation of additional transformer equipment to provide improved lighting service for the Fourteenth ward district of the city.

Hershey, Pa.—Hershey Chocolate Co. has completed foundation work in connection with construction of its new one and 5-story plant addition, for increased operations. The structures will comprise manufacturing building and power plant, about 100 by 400 ft. and 130 by 140 ft., respectively, and are estimated to cost, including equipment and machinery installation, about $500,000. A. C. Wood, 1411 Walnut street, Philadelphia, is the contractor.

Marietta, Pa. — Farmers' Electric Co., a new organization which recently filed articles of incorporation with a capital of $30,000, is planning for the operation of a local electric light and power plant. Plans have been erected for the construction of a pole line extending from Washingtonboro to Mountville, active work on the proposed construction to be inaugurated as soon as weather conditions permit. John H. Ware is president of the new company.

McKeesport, Pa.—Fire on February 8, totally destroyed the plant of the McKeesport Ice & Cold Storage Co. with loss to this company estimated at about $125,000. The fire also destroyed adjoining structures, bringing the total loss up to approximately $600,000. Large quantities of refrigerating apparatus and electric equipment were also destroyed.

Philadelphia, Pa. — General Manufacturing Co., Bigler street and Delaware avenue, has awarded a contract to Henry P. Friend, Philadelphia, for the erection of a new addition to its boiler plant and alterations and improvements in the engine room at the works, to facilitate operations.

Pittsburgh, Pa.—McGraw Wool Co. has had plans prepared for the construction of a new pumping building at its plant located at the foot of Pine street, Northside district, fronting on the Allegheny river.

Pittsburgh, Pa. — Pittsburgh Reflector & Illuminating Co., 3117 Penn avenue, has taken bids for the construction of its proposed new 1-story plant to be located at Irwin, Pa. The structure will be about 70 by 100 ft., and will be used for increased operations. E. S. Simons is secretary.

Reading, Pa.—Metropolitan Edison Co. has recently inaugurated operations on the construction of a new 66,000 volt high-tension transmission line to extend to Pottsville, a distance of about 36 miles. It is proposed to utilize the new line for furnishing electric energy to the lower anthracite region and upper Schuylkill river valley. In connection with the work, the company has had plans prepared for the erection of a new 5000 kw. transformer station at Hamburg, about half way to Pottsville, and another transformer station in the same locality of 1500 kw. capacity. Contract for furnishing the transformer equipment has been awarded to the Hamburg Gas & Electric Co., Hamburg.

Baltimore, Md.—In arranging plans for municipal improvements, the New Annex Advisory Commission has submitted a report calling for an appropriation of $1,000,000 for improvements in the lighting system and underground-conduit systems, covering approximately 230,000 lineal feet of trunk conduits and 200,000 lineal feet of lateral conduits.

Baltimore, Md.—Electromechanical Co., 530 North Calvert street, has had plans prepared for the remodeling and improvement of its 4-story building, aggregating about 20,000 sq. ft. of floor space, for increased operations. W. D. Young is president.

Portsmouth, Va.—Extension of the white way system on High street, from Chestnut street to the Belt line, and also extension of the system for two blocks on Crawford street, east and west of High street, is council plan. Manager W. B. Bates was instructed to have estimates prepared on the cost of the proposed improvements.

Elkins, W. Va. — City is having plans prepared for the installation of new electric light and waterworks systems for municipal service. In connection with other city work, the project is estimated to cost about $500,000. The Roberts Engineering Co., Charleston, is consulting engineer.

Atkinson, N. C.—Atkinson Power & Light Co., recently incorporated, has perfected its organization, and is arranging plans for the installation of a local transmission system, the work being estimated to cost $10,000. L. M. Thompson, Montgomery, N. C., is secretary and general manager.

Lexington, N. C.—Georgia-Alabama Power Co. has filed notice with the Secretary of State of an increase in its capitalization from $3,000,000 to $5,000,000, for general business expansion.

Prosperity, N. C.—$35,000 in bonds have been voted for the construction of an electric power line and the installation of electric lights. The idea is to connect with the Southern Power Co. lines at Mollohon mill, six miles away.

Wilson, N. C.—Plans are being arranged by the Town Commissioners for the construction of a new municipal hydroelectric plant. The project will include the construction of a new dam, power plant, outdoor transformer station, headworks, and 13,000-volt capacity transmission line, about four miles in length. L. J. Herman is chairman of the commission; Lee MacEwan & Turnbull, Realty building, Charlotte, N. C., are architects and engineers.

Bamberg, S. C.—Commissioners of Public Works, J. G. Black, superintendent and engineer, have awarded a contract to the J. B. McCrary Co., Atlanta, Ga., for the construction of a new brick and concrete power plant, about 50 by 75 ft., for municipal service. The equipment will include generator, condenser and auxiliary apparatus, the plant being estimated to cost $40,000.

Columbus, Ga. — Plans have been completed for a white way. Address Mayor Couch.

NORTH CENTRAL STATES.

Canton, O. — Eclipse Electric Co. has increased its capital stock from $10,000 to $50,000 to take care of the growth of its business, which has more than doubled in the past year.

Cleveland, O.—Thomas S. Farrell, city director of lighting, will petition the common council for $1,000,000 for city lighting system.

Hamilton, O. — $650,000 in bonds have been authorized for enlarging electric light plant.

Lima, O. — Because of the rapid growth of the plant and service of the Lima Telephone & Telegraph

Co., plans for an addition to its present building on South Elizabeth street are being made. Address D. J. Cable, president.

Shelby, Ohio.—Huron Valley Light & Power Co. will build a high-tension line from Shelby to Plymouth in order to furnish power to Plymouth, Greenwich, Willard, Shiloh and other villages.

Decatur, Ind.—A foundry will be established in this city by an Ohio foundry company. It will make castings for the General Electric Co.'s new plant, now being erected here, for the same company's plant at Fort Wayne Ind., for the Ford Motor Co., Detroit, Mich., and the Willys-Overland Co., at Toledo, O. The new company will employ 400 people.

Indianapolis, Ind. — Plans for the erection of a club-house at North Indianapolis to cost $40,000 are being considered by the Debonair Club Home Association.

Logansport, Ind. — Ward Brown and J. W. Sharrick, of Indianapolis, owners of the Barnett Hotel, recently destroyed by fire, are working on plans to erect a $500,000 hotel in Logansport.

Richmond, Ind.—The Wayne Light & Power Co., capitalized at $10,000, which recently filed articles of incorporation with the secretary of state, expects to supply electric current to the towns of Webster, Williamsburg, Economy and Greensfork, all in Wayne county.

Seymour, Ind. — Seymour Water Co. will rebuild its steam plant and will also build a new sedimentation basin of 2,000,000 gallons capacity, designed to improve the filtration plant. The company recently installed hydraulic power equipment and operates its steam plant only when the condition of White river will not permit the operation of the water power system.

Carrollton, Ill.—Carrollton purposes to build its own electric light plant.

Chicago, Ill.—The wholesale plant and factory of the American Electrical Supply Co., 953 West Washington boulevard, was practically destroyed by fire Feb. 19. The loss is estimated at $15,000, covered by insurance.

Chicago, Ill.—General Combustion Co., Monadnock building, has purchased land on the northwest side of Chicago, and has awarded a contract for the erection of the first unit of a new plant. This building, which will provide 10,000 sq. ft. of floor space, will be used for storage purposes. Machine shops, fabricating shops and an office building will be erected later.

Lockport, Ill.—Architect G. S. Williams, 134 S. LaSalle street, Chicago, has prepared plans for a $3,000,000 hydroelectric plant to be erected by the Sanitary District of Chicago. Building will be 6-stories high, brick, steel, and concrete construction. Specifications include steam heating, plumbing, composition roof, fireproof interior finish and electric lighting.

Quincy, Ill.—City council is planning ways and means to extending boulevard lighting. Address city clerk.

Detroit, Mich.—The First & Old Detroit National bank has awarded the Foundation Co., Detroit, the contract for the bank's office building, which is to occupy the site of the Pontchartrain Hotel, recently closed. The structure wil cost approximately $8,000,000 and will be 24 stories in height.

Muskegon, Mich.—The Miami Motor Co. of Chicago will actively take up the installation in Muskegon of pig iron blast furnaces, which will put out over 500 tons of metal daily for the use of all of the local foundries. As a by-product the concern will manufacture 11,000,000 cubic feet of gas a day. The concern will commence immediately the building of a $500,000 plant on the shores of Lake Muskegon and is expected to expand in the first year to a plant worth over $20,000,0000.

Kohler, Wis.—Bonds will be voted to extend electric light system. Address village clerk.

Milwaukee, Wis.—An ordinance has passed the city council providing for an issue of $400,000 electric light bonds. Address P. F. Leuck, city clerk.

Milwaukee, Wis.—Milwaukee Rolling Mill Co. has engaged the Northwestern Bridge & Iron Co., Milwaukee, as designing and construction engineer for a new mill. The Milwaukee Electric Crane & Manufacturing Co. will furnish two 40-ton cranes with 10-ton auxiliary hoist and three 10-ton cranes.

Shawano, Wis. — The Commercial club will purchase power for city light plant from the Central Wisconsin Power Co. Address Paul Capraro, superintendent, city plant.

Waupaca, Wis. — Bids will be received March 2 for remodeling power house in Soldiers' Home. Builders & Traders Exchange, Milwaukee, are preparing plans. Address John G. D. Mack, state chief engineer, Madison, Wis.

Davenport, Ia.—Blackhawk Hotel Co. will erect a 4-story addition to the hotel to cost $250,000.

Attica, Kans.—The improvement of electric light plant is being contemplated. Address J. C. McCaddon, city clerk.

Claflin, Kans. — The telephone exchange owned by the Claflin Light, Phone & Garage Co., which was recently destroyed by fire will be rebuilt at once.

Clay Center, Kans.—A transmission line 12 miles long is being contemplated by Public Utilities Commission, C. S. Callender, superintendent, Clay Center.

Grenola, Kans.—Lighting plant will be improved. Address Edgar Robertson, superintendent of public works.

Kansas City, Mo. — The Kansas City Telephone Co. will install 10,000 automatic telephones this year. The general offices will be removed in April to the new building at 11th and Oak streets. Following the installation of the first 10,000 automatics, the equipment in the entire city will be changed to that type. The final elimination of the present manual system will not take place for about seven years, according to estimates of the company.

Lincoln, Neb.—At the spring election the question of issuing $300,000 municipal lighting bonds will be voted on. Address mayor.

Yankton, S. D.—An ordinance has passed the city council giving authority to the Eastern Dakota Electric Co. to furnish and distribute electricity for light, heat and power. Address John W. Summers, city clerk.

SOUTH CENTRAL STATES.

Mobile, Ala.—The Southern Bell Telephone & Telegraph Co. will expend $165,000 to improve building and install machinery.

Starkville, Miss.—City council has had plans prepared for extensive improvements in the municipal electric light and waterworks plant. It is proposed to erect a new building at the former works, the equipment installation to comprise boiler, superheater, stock, economizer, stoker, boiler-feed pumping apparatus, generator units, air-compressor equipment, and auxiliary apparatus. Bonds for $55,000 were recently approved for this work. Williams & Lebby, Yazoo City, Miss., are engineers.

Bastrop, La.—Gary Robertson, superintendent of electric light and water department of the city, is contemplating installing 150 hp. natural-gas engine, 100 kw. generator and extending line.

Vinton, La.—Plans are under consideration by the City Commission for the acquirement of the Vinton Water, Light & Power Co. It is proposed to issue bonds for $90,000, to be used for the purchase of the property.

Mountain Grove, Ark.—Ed. J. Green has petitioned for authority to erect towers and poles through the county and along the county roads for the purpose of building a transmission line from Double Springs to Ganesville and Mountain Grove.

Tillar, Ark.—Tillar Light & Power Co. is considering plans for the immediate construction of a new local electric light and power plant.

Springdale, Ark. — The Springdale Light & Power Co. will install a street-lighting system. Address V. McDaniel, Fayetteville, Ark.

Albany, Tex. — Chamber of Commerce is promoting the construction of an electric light and power plant here. If this is not done the American Public Service Corp. of Dallas may build an extension of it high-power electric transmission line from Abilene to Albany, it is stated.

Brownwood, Tex.—The city council has appropriated $50,000 for the construction of a municipal electric light plant.

Caldwell, Tex.—The Caldwell Electric Power and Ice Co. will install a new 100-hp. engine and other machinery and equipment in its electric light and power plant here.

WESTERN STATES.

Helena, Mont. — A hydroelectric plant near Rimini to generate power for operating the street-lighting system of Helena is being considered by the city council. With wood pipes the project will cost $125,000, according to figures submitted; concrete pipes, $175,000, and steel pipes, $225,000.

Downey, Ida.—This city is to have a new street-lighting system to be installed in the early spring, to consist of sixteen 400-candlepower type "C" units.

Salt Lake City, Utah.—Practically a 50% wage increase has been demanded by employes of the Utah Light & Traction Co.

Santaquin, Utah.—This town is the latest in this section of the country to consider the installation of white way lighting for its business district.

Centralia, Wash.—Kane Pneumatic Shock Absorber Co. has plans under way for the construction of a new power plant at Fords Prairie, near Centralia, with capacity of about 500-kw.

Roseburg, Ore. — Roseburg will hold a bonding election in May for the purpose of raising money to install a municipal electric light and power plant, and a city water system.

Bakersfield, Cal.—The new plant of the San Joaquin Light & Power Corp., Fresno, preliminary construction on which has been inaugurated, will approximate closely $5,000,000 in aggregate cost. The plant will be erected in units, and the first unit, estimated to cost about $950,000, is designed to develop a capacity of about 17,500 hp. Orders are being placed for considerable equipment, including generating apparatus, boilers, etc.

Hermosa Beach, Cal.—Considerable electrical and mechanical equipment will be required for the proposed new plant of the Hermosa Glass Co., the construction work for which is now under way. The plant is estimated to cost about $100,000.

Los Angeles, Cal.—Public Service Commissioners have approved the plans submitted by the police department for the use of the municipal street-lighting system for signalling policemen while on duty. A 3-flash system will be used, calling police patrolmen to the boxes to receive orders for headquarters.

Los Angeles, Cal.—Pacific Electric Railway Co. is planning for the immediate rebuilding of its substation at Wilmington, recently destroyed by fire with loss of about $10,000.

Los Angeles, Cal.—The first step toward the electrification of all the steam roads on the Pacific coast was taken here with the announcement of a plan to install electric locomotives for switching service in the Los Angeles terminals of the Santa Fe, Salt Lake and Southern Pacific. Poles have already been erected on Alameda street to carry the high-voltage wires.

Los Angeles, Cal. — Kelman Electric & Manufacturing Co., 1650 Naud street, manufacturer of oil-operated switches for high-tension lines, has increased its capital to $100,000, for general business expansion.

Oakdale, Cal.—Board of City Trustees is arranging for the installation of new street-lighting equipment to increase the present system about 25%. A plan is also being considered providing for the acquirement of the present street-lighting system now owned and operated by the Sierra & San Francisco Power Co.

Richmond, Cal. — Western States Gas & Electric has made a physical connection with the high-tension lines of the Pacific Gas & Electric Co. for increased local service. The new line connects with the 60,000-volt line of the Pacific company in the San Pablo valley.

San Bernardino, Cal.—City council is completing plans for an ornamental street-lighting system on East Fourth street, between Pine and Alamitos avenues. The installation will comprise a 12-foot high iron post with two arms each carrying a lamp.

San Diego, Cal.—Navy Department, Bureau of Yards & Docks, has completed plans for the construction of a large power plant with distributing system at its local property, and will ask construction bids at once. The electrical end will include two alternators, switchboard, transformers, and other equipment. The distributing system will be underground, and will include fibre and terra cotta ducts, etc. The work is estimated to cost about $150,000.

Turlock, Cal.—$1,280,000 in bonds have been voted for improving electric light plant. Address city clerk.

Vallejo, Cal. — Vallejo Electric Light & Power Co. has completed plans and will soon break ground for its proposed new 3-story power plant to cost about $70,000.

INCORPORATIONS

Picher, Okla.—Picher Electric Co. Capital, $15,000. To operate a local electric light and power plant. Incorporators: V. L. Hesterly, and W. T. Landrum.

Nashville, N. Y.—Nash Power Co. Capital, $200,000. To operate a local electric generating plant. Incorporators: N. C. and J. M. Warren, and S. F. Austin.

Atkinson, N. C.—Atkinson Light & Power Co. Capital, $5000. To operate a plant for electric light and power service. Incorporators: E. S. Page, and R. S. Carr.

Wheeling, W. Va.—Ohio Generator Co. Capital, $100,000. To manufacture generating equipment. Incorporators: G. S. Houston, E. M. Rodebaugh, and P. Boyd.

Columbia, S. C. — Capital Storage Battery Co. Capital, $40,000. To manufacture electric storage batteries, etc. W. B. Mitchell is the principal incorporator.

Vancouver, B. C. — The Shipton Electric Pig Iron and Steel Smelting Co., Ltd., has been incorporated here for $250,000.

Richmond, Ind.—Wayne Light & Power Co. has incorporated with capital stock of $10,000. Clarence A. Kleinknecht, Henry C. Starr, and William M. Bailey are incorporators.

Tonawanda, N. Y. — King Electric Co. has been incorporated with capital stock of $25,000 to manufacture electrical specialties. L. Smith, P. Kisler, and V. F. King, 48 Main street, Tonawanda, are incorporators.

Montreal, Que.—Canadian Electric Steel, Ltd., has been incorporated with capital stock of $5,000,000 to manufacture iron and steel products, machinery, etc. William J. Shaughnessy, Chilion G. Heward, and Herbert W. Shearer are the principal incorporators.

Madison, Wis. — Automotive Electric Service Co. has been incorporated with capital stock of $20,000 by A. X. Merz, R. J. Nickles, and T. T. Coleman, who are affiliated with the Madison-Kipp Corporation. A 4-story service station and machine shop, 60 by 250 ft. will be erected.

Taylorville, Ill. — The Armstrong Engineering Company has been incorporated with capital of $30,000 by H. G. Armstrong, Ritchie R. Simpson and Judson Rucker. The company will engage in general engineering and construction work.

New York, N. Y.—J. I. Robins & Sons. Capital, $250,000. To manufacture electric and gas fixtures, etc. Incorporators: E. London, J. E. and B. J. Robin, 130th street and Park avenue.

New York, N. Y. — Automobile Electric Devices Corp. Capital, $5000. To manufacture electrical specialties. Incorporators: M. V. Sarvas, and D. Lobel, 47 West 42nd street.

New York, N. Y.—Rocky Mountain Power Co. incorporated under Delaware laws with a capital of $500,000. To operate an electric light and power system. Walter Challaire, Reuben B. Crisfield, and Charles MacGregor, New York.

Asbury Park, N. J.—Electric Sun Co., 4th and Railroad avenues. Capital, $80,000. To manufacture electrical display specialties. Incorporators: Arthur J. Haight, Charles T. Day, and Albert Klebs, Asbury Park.

Providence, R. I.—Maille Electric Co., Inc. Capital, $30,000. To manufacture electrical goods. Incorporators: Charles J. McKenna, Frederick E. Roberts, and Alfred F. Maille. Providence.

Guys Mills, Pa.—Randolph Electric Light & Power Co.. Nominal capital, $5000. To operate an electric light and power plant for local service. W. C. Wald is the principal incorporator.

Baltimore, Md.—Maryland Electric & Power Co., 408 East North avenue. Capital, $250,000. To operate an electric generating plant. Incorporators: Edmund L. Oldfield, Frank H. Durkee, and Charles H. Wilson.

Personals

Western Electric Executive Made Legion of Honor Member by French Government—G. C. Miller Leaves A. E. & C. R. R.

A. P. GIFFING, a member of the Delaware State Public Utilities Commission, Wilmington, Del., has resigned.

GEORGE R. VAN NAMEE, Watertown, N. Y., has been appointed up-state public service commissioner by Governor Smith, to succeed Thomas F. Fennell.

MAJOR EDWARD L. SHERWOOD has been appointed assistant secretary of the Illuminating Engineer Society, with offices in the United Engineering building, New York City.

EDWOOD E. OPLINGER, 925 Pine street, Allentown, Pa., has been appointed to take charge of the advertising of the Lehigh Electric Co., 15-17 North Sixth street, Allentown.

P. D. MACKEY has resigned his position in charge of the electric steel department of Henry Disston & Sons Philadelphia, to become general superintendent of the Eastern Steel Co., Pottsville, Pa.

HAROLD D. SAMMIS, since July, 1913, connected with the California Railroad Commission in various capacities, resigned on Feb. 1, to become secretary of the Public Service Commission of Nevada.

C. L. S. TINGLEY, vice-president of the American Railways Co., Philadelphia, Pa., recently tendered an interesting address at the weekly luncheon of the Kiwanis club, held at the Hotel Traylor, Allentown, Pa.

FREDERIC R. BUSSLER has been appointed plant superintendent of the Salem (Mass.) Electric Lighting Co. Mr. Bussler has been connected with the electrical industry for 21 years and for some time was connected with the Edison Electric Illuminating Co., Boston, Mass., as commercial engineer.

SAM FAIRWEATHER, city electrician of Sheboygan, Wis., since the establishment of that office with the exception of an eight-month period, has resigned his office, and will engage in a general electrical business in Sheboygan.

JAMES T. HUTCHINGS, president and general manager of the Rochester Gas & Electric Corp., Rochester, N. Y., has resigned, to become assistant general manager of the United Gas Improvement Co., Philadelphia, Pa., one of the largest public service holding companies in this country. Mr. Hutchings' resignation is effective April 1.

L. H. ROSENBERG, formerly assistant engineering editor of the *Electrical World*, is now associated with the Westinghouse Electric & Manufacturing Co., department of publicity, at East Pittsburgh, Pa. In his new position Mr. Rosenberg will prepare engineering articles for technical papers. He is a graduate of the electrical engineering course of Armour Institute of Technology, Chicago.

WILLIAM H. DOHERTY, formerly with the Reading Steel Castings Co., has joined the sales force of the Connecticut Electric Steel Co., Inc., Hartford, Conn.

CHAUNCEY D. SNOW, United States commercial attache at Paris, who is quite well known to foreign sellers, has resigned to head a newly created foreign department at the Chamber of Commerce of the United States.

JAMES R. WOOD has been named assistant superintendent of the Urbana & Champaign Railway, Gas & Light Co., with headquarters at Champaign, Ill. The position is a new one and has been created for Mr. Wood. He has been with this company for 24 years.

G. C. MILLER, manager of the light and power department of the Aurora, Elgin & Chicago Railroad Co., is leaving that company Mar. 1 to engage in the electrical merchandising business in Kokomo, Ind., under the firm name of the Lacey-Miller Co.

H. O. STEWART, who has been connected with the Rochester, N. Y. Light & Power Co., as engineer in the industrial department, has become production manager of Max Lowenthal & Sons, Rochester, N. Y. In his new position Mr. Stewart will make a complete survey of the motors in the plant with a view of obtaining efficient operation.

LIEUTENANT-COLONEL HERBERT E. SHREEVE, in charge during the world war of the division of research and inspection, United States Signal Corps, with headquarters in Paris, France, and now head of the transmission department of the Western Electric Co., has been made a Chevalier De La Legion D'Honneur, of France.

R. D. PATTERSON, formerly with the Northwestern Electric Equipment Co., New York City, has been appointed eastern representative of the Lindsley Brothers Co., dealers in poles, crossarms, posts and ties, with headquarters at Spokane, Wash. Mr. Patterson will have offices at 50 Church street, New York City.

BASSETT JONES, consulting engineer, New York City, will give a dinner at the Hotel Biltmore on March 1 for about 20 professional engineers employed by several large eastern operating companies. The companies from which the engineers are invited include J. G. White & Co., Stone & Webster, Cities Service Co., New York Edison Co., the Interborough Rapid Transit Co. and others. The speakers at the dinner will be L. K. Comstock, W. C. Peet, W. L. Goodwin and Sullivan W. Jones, secretary of the Conference Club. The subjects to be discussed will be related to the Conference Club and its reorganization.

Obituary.

JOHN FROMBERGER, Passaic, N. J., a well-known electrical contractor of that section, died on February 17, aged 29 years.

JAMES C. PHELPS, president of the C. & P. Electric works, of Springfield, Mass., manufacturer of barrier panels and cabinets, died Feb. 17, from the effects of influenza and pneumonia.

JAMES W. SEE, nationally known as a consulting engineer and patent attorney, died at his home, Hamilton, O., on Jan. 31, last, aged 70 years. Mr. See was a contributor at different times to many technical publications and also published several volumes on telephone engineering.

HAROLD MCGILL DAVIS, for 20 years manager of the advertising department of the Sprague Electric Works of the General Electric Co., died at his home in Brooklyn, N. Y., Feb. 9, after a lingering illness, aged 60 years. Mr. Davis was born in Jerseyville, Ill., and was the son of Samuel W. and Mary J. McGill Davis. His early boyhood days were spent in Paoli, Kan., where his father was town treasurer for 13 consecutive years.

After a public school education in Paoli Mr. Davis finished his education in a St. Louis, Mo., high school and started to work as an office boy in a lead and oil factory. While in high school he became a charter member of a cadet corps which was later mustered into the Second Regiment, Missouri National Guard. Mr. Davis advanced to a second lieutenant in this organization.

After spending several years with the oil and lead company he resigned to become chief clerk of the United States Assay office in St. Louis, receiving his appointment from President Arthur, but he later left this position to go to New York City to study architecture. Being active in church work he was elected president of the Brooklyn Christian Endeavor Union, an organziation numbering 6000 members, in 1901, and the following year was made chairman of the printing committee in connection with the Christian Endeavor convention attended by 60,000 delegates in New York City.

The financial panic of 1893 offered him a chance to get into the advertising business, in which he had some experience as a writer and designer while in St. Louis. For four years he was advertising manager of a trade paper in New York City, afterward becoming connected with an advertising agency, thus broadening his experience and fitting him for his final position with the Sprague Co., which he obtained in Dec., 1899. Mr. Davis is survived by a wife and young daughter.

Financial News

Commonwealth Edison Net Income Shows $89,332 Decrease.

Commonwealth Edison Co., Chicago, operating revenues for the year ended Dec. 31, 1919, show an increase of $3,861,290 with an increase in the gross income of $128,569. Net income, however, shows a decrease of $89,332, when compared with the previous year. Interest on the funded debt in 1919 amounted to $2,299,236 as compared to $2,131,550 in 1918. Uncollectable operating revenue amounted to $119,938 during 1919. The company entered 1920 with a surplus of $7,614,189.

The earnings and expenses for the year were as follows:

Electric operating revenues		$30,366,426.43
Electric operating expenses (including amortization and depreciation, $2,880,254.77)		19,519,506.74
Net electric operating revenues		$10,846,919.69
Other charges:		
Uncollectable operating revenue	$ 119,938.53	
Taxes assignable to electric operations	2,355,000.00	
Municipal compensation	895,193.34	
		$3,370,131.87
Net operating income		$7,476,787.82
Other income		619,801.99
Gross income		$8,096,589.81
Deductions from gross income		950,213.95
		$7,146,375.86
Interest on funded debt		2,299,236.92
Available for dividends		$4,847,138.94
Dividends paid		3,942,340.00
Balance carried to surplus		$ 904,798.94
Balance total surplus unappropriated Dec. 1, 1919		7,614,189.00

Public Service Co.

The Public Service Company of Northern Illinois, showed for 1919 a balance carried to surplus after common and preferred dividends of $109,735. The earnings and expenses for the year were as follows:

Operating revenues (not including merchandise sales)		$9,086,226.21
Operating expenses (including depreciation, $430,660)		5,560,783.00
Net operating revenues		$3,525,443.21
Net operating income		3,178,255.60
Other income		239,687.02
Gross income		$3,417,942.62
Deductions from gross income		169,029.58
		$3,248,913.04
Interest on funded debt		1,902,706.51
Available for dividends		$1,346,206.53
Dividends paid:		
Preferred stock	455,280.00	
	$ 890,926.53	
Common stock	781,191.25	
Balance carried to surplus		$ 109,735.28

Western Electric Stockholders Ratify New Stock Plan.

At the special meeting of the stockholders of the Western Electric Company on Feb. 19 the plan calling for an increase in the authorized stock of the company from 150,000 shares of no par value to 500,000 shares was ratified. The plan calling for the authorization of $50,000,000 7 per cent cumulative preferred stock was not acted on, but will be taken up at another special meeting on March 12.

It is proposed to offer 200,000 shares of the newly authorized common stock to present common stockholders at $180, in proportion of 1⅓ shares for each share now held.

A call for the redemption of the present outstanding 6 per cent preferred stock will be issued at once, the callable price being $120 a share and accrued dividends.

Niagara Falls Power Co.

Consolidated income account of the Niagara Falls Power Co. and Canadian Niagara Power Co., for the year ended Dec. 31, 1919, shows surplus after charges of $2,084,056, equivalent, after deduction of 7% preferred dividends, to $8.82 a share ($100 par value) earned on the $14,484,600 common stock, as compared with surplus of $1,901,683, or $7.56 a share, earned on the $14,484,566 common stock in 1918.

Consolidated income account for the year ended Dec. 31, 1919, compares as follows:

	1919.	1918.
Total operating rev.	$5,098,100	$5,016,366
Net operating rev.	3,170,542	2,879,292
Net income	3,445,286	3,240,875
Surplus after charges	2,084,056	1,901,683
	1917.	1916.
Total operating rev.	$3,225,115	$3,062,836
Net operating rev.	2,017,229	2,210,939
Net income	2,195,805	2,365,815
Surplus after charges	1,200,065	1,362,116

Shawinigan Water & Power Co.

Shawinigan Water & Power Co., Montreal, Inc., in 1919, after all reserves had been provided for and dividends had been paid, added $12,840 to its profit and loss surplus, bringing that account to $30,350. Before showing its net revenue of $1,473,743 as against $1,410,094 a year ago, $300,000 was transferred to depreciation as compared with $100,000 the previous year. Gross earnings were $3,727,045, against $3,621,074.

B. R. T. Shows Good Gain.

Brooklyn Rapid Transit System for 11 months, February to December, 1919, shows gross income of $14,814,987, with operating expenses of $11,914,268, giving net earnings of $2,900,719, according to statement from Carl M. Owen, counsel for company. For six months ending Dec. 31 operating revenue was $9,057,492 and expenses $7,375,169.

Pennsylvania Bell Telephone Co.

Bell Telephone Co. of Pennsylvania for the year ended Dec. 31, 1919, reports surplus, after charges and dividends, of $381,268, as compared with surplus of $391,752 for the seven months ended July 31, 1918:

	*1919.	†1918.
Gross	$11,468,598	$14,297,605
Net	2,188,981	2,575,928
Other income	274,974	.....
Gov. compensation.	2,253,718	.....
Total income	$ 4,717,673	$ 2,575,928
Interest, etc.	736,405	384,176
Balance	$ 3,981,268	$ 2,191,752
Dividends	3,600,000	1,800,000
Surplus	$ 381,268	$ 391,752.

*Excludes all revenues accrued to and expenses borne by the U. S. Government for Federal control period from July 1, 1919, to July 31, 1919.

†For the seven months ended July 31, 1918.

Dividends.

Cities Service Co. has declared the regular monthly cash dividend of ½ of 1% on the common, preferred and preference B stocks, and the usual stock dividend of ¼ of 1% in common stock on the common stock, all payable April 1 to holders of record March 15.

American Light & Power Co. has declared its usual quarterly dividend of 1% on the common stock, payable March 1 to stockholders of record Feb. 19.

American Telephone & Telegraph Co. has declared the regular quarterly dividend of $2 a share on the first preferred stock, payable April 15 to stockholders of record March 19.

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate. Per cent.	Bid Feb. 17.	Bid Feb. 24.
Adirondack Electric Power of Glens Falls, common	6	16	13
Adirondack Electric Power of Glens Falls, preferred	6	78	76
American Gas & Electric of New York, common	10+extra	121	121
American Gas & Electric of New York, preferred	6	39	39¼
American Light & Traction of New York, common	..	180	190
American Light & Traction of New York, preferred	6	88	88
American Power & Light of New York, common	4	57	59
American Power & Light of New York, preferred	6	70	71
American Public Utilities of Grand Rapids, common	..	7	3
American Public Utilities of Grand Rapids, preferred	7	18	18
American Telephone & Telegraph of New York	..	97½	97½
American Water Works & Elec. of New York, common	..	2	2
American Water Works & Elec. of New York, particip	7	4	4
American Water Works & Elec. of New York, first preferred	..	47	47
Appalachian Power, common	..	2½	3
Appalachian Power, preferred	7	20	15
Cities Service of New York, common	+extra	365	365
Cities Service of New York, preferred	6	69	69
Commonwealth Edison of Chicago	8	106½	106¼
Comm. Power, Railway & Light of Jackson, common	..	17	17
Comm. Power, Railway & Light of Jackson, preferred	6	37½	37½
Federal Light & Traction of New York, common	..	6	6
Federal Light & Traction of New York, preferred	..	43	44
Middle West Utilities of Chicago, common	..	18	18
Middle West Utilities of Chicago, preferred	..	36	42
Northern States Power of Chicago, common	..	56	55
Northern States Power of Chicago, preferred	ex.div.7	86	86
Pacific Gas & Electric of San Francisco, common	..	51	51
Public Service of Northern Illinois, Chicago, common	7	77	77
Public Service of Northern Illinois, Chicago, preferred	6	85	84
Republic Railway & Light of Youngstown, common	4	14	14
Republic Railway & Light of Youngstown, preferred	6	46	46
Standard Gas & Electric of Chicago, common	..	20	19
Standard Gas & Electric of Chicago, preferred	6	38½	38
Tennessee Railway, Light & Power of Chattanooga, common	..	1	1
Tennessee Railway, Light & Power of Chattanooga, preferred	6	7	7
United Light & Railways of Grand Rapids, common	4	24	24
United Light & Railways of Grand Rapids, preferred	6	59	60
Western Power of San Francisco, common	..	20	18½
Western Union Telegraph of New York	extra	84	84
Industries.			
Electric Storage of Philadelphia, common	4	112	113
General Electric of Schenectady	8	157	157
Westinghouse Electric & Mfg. of Pittsburgh, common	7	50¼	51